VOL. 7 NO. 10
May 31, 1982

Energy Research Abstracts

ABSTRACTS 27629-28975

Technical Information Center
UNITED STATES DEPARTMENT OF ENERGY

CURRENT AWARENESS PUBLICATIONS ON ENERGY

To provide complete coverage of literature related to major Department programs, announcement publications that are comprehensive in their coverage of certain energy fields are issued regularly. All information in these publications, plus additional backup information, is included in the Energy Data Base of the Technical Information Center; all references are also available for machine searching via the on-line retrieval system, DOE/RECON, and the commercial on-line retrieval systems. Descriptions of these current awareness publications, which are supported either directly or indirectly by the DOE, appear below. Department of Energy components may receive the listed publications free from the Technical Information Center, P.O. Box 62, Oak Ridge, TN 37830. Telephone (615) 576-1303; (FTS) 626-1303.

PUBLICATIONS OF THE TECHNICAL INFORMATION CENTER

Energy Abstracts for Policy Analysis (EAPA)

A monthly abstract journal devoted to the analysis of energy research, conservation, and policy. Scope and coverage are limited to substantive articles or reports and emphasize the following: programmatic efforts; legislative, regulatory, and other legal aspects; social, economic, and environmental impacts; regional and sectoral analyses; institutional factors, etc. *EAPA* is available from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402; domestic subscribers $4.50, foreign $5.65 per copy; annual cumulative index, domestic $7.00, foreign $8.75 per copy. The annual subscription price is $48.00 for domestic subscribers and $60.00 for foreign subscribers.

Energy Research Abstracts (ERA)

A comprehensive semimonthly abstract journal devoted to all areas of energy-related information produced by the Department of Energy, other U. S. government organizations, and foreign governments. *ERA* is available to the public on a subscription basis from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402. The subscription rate for the 24 semimonthly issues is $150.00 for domestic subscribers and $187.50 for foreign subscribers. A single issue costs $6.50 (domestic) or $8.15 (foreign).

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Nuclear Fuel Cycle (NFC)

A semimonthly current awareness bulletin covering all aspects of the nuclear fuel cycle, both front end and back end. Available as PB82-913400.

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Radioactive Waste Management (RWM)

A semimonthly current awareness bulletin covering the following management aspects: transport and storage, waste processing, waste disposal, waste storage, radioactive effluents, and shipping containers. Available as PB82-902900.

INTERNATIONAL ENERGY PUBLICATIONS

Atomindex (Published in cooperation with the Technical Information Center by the International Atomic Energy Agency, International Nuclear Information System, Vienna, Austria)

A semimonthly abstract journal devoted to information on nuclear science and technology. Through an exchange agreement, IAEA/INIS provides all non-U. S. nuclear information of *Atomindex* to TIC for inclusion in the Energy Data Base; in turn, TIC provides all U. S. nuclear information to IAEA/INIS for inclusion in *Atomindex*. *Atomindex* is available by subscription from UNIPUB, 345 Park Avenue South, New York, NY 10010. The cost of an annual subscription, 24 semimonthly issues and semiannual and annual cumulative indexes, is $290.

Coal Abstracts (Published in cooperation with the Technical Information Center by the International Energy Agency, IEA Coal Research, London, England)

A monthly abstract journal devoted to information on coal. Through an exchange agreement, IEA Coal Research provides non-U. S. coal information of *Coal Abstracts* to TIC for inclusion in the Energy Data Base; in turn, TIC provides all U. S. coal information to IEA Coal Research for inclusion in *Coal Abstracts*. *Coal Abstracts* is available to Department of Energy components and contractors from the Technical Information Center. Non-DOE organizations may obtain *Coal Abstracts* from IEA Coal Research, Technical Information Service, 14-15 Lower Grosvenor Place, London SW1W 0EX, England, for 100 pounds sterling per year.

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ENERGY RESEARCH ABSTRACTS

ABOUT THE TECHNICAL INFORMATION CENTER

The Technical Information Center in Oak Ridge, Tennessee, has been the national center for scientific and technical information for the Department of Energy (DOE) and its predecessor agencies since 1946. In developing and managing DOE's technical information program, the Center places under bibliographic control not only DOE-originated information but also worldwide literature on scientific and technical advances in the energy field and announces the source and availability of this information. Whereas the literature of science is emphasized, coverage is extended to DOE programmatic, socioeconomic, environmental, legislative/regulatory energy analysis, and policy-related areas. To accomplish this mission, the Center builds and maintains computerized energy-information data bases and disseminates this information via computerized retrieval systems and announcement publications such as abstracting journals, bibliographies, and update journals. Direct access to the Center's most comprehensive data base, the Energy Data Base, is available to the public through commercial on-line bibliographic retrieval systems. The Energy Data Base and many of the Center's energy-related data bases are available to DOE offices and contractors and to other government agencies via DOE/RECON, the Department's on-line information retrieval system. The Center has developed and maintains systems to record and communicate energy-related research-in-progress information, to catalog official DOE issue-and-policy documents, to maintain a register of DOE public communications publications, to track research report deliverables from DOE contractors, and to test and make available DOE-funded computer software programs with scientific and management applications. The Center also maintains a full-scale publishing capability to serve special publication needs of the Department. To effectively manage DOE's technical information resources, the Center's program is one of continual development and evaluation of new information products, systems, and technologies.

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ABOUT *ENERGY RESEARCH ABSTRACTS*

Energy Research Abstracts (ERA) provides abstracting and indexing coverage of all scientific and technical reports, journal articles, conference papers and proceedings, books, patents, theses, and monographs originated by the U. S. Department of Energy, its laboratories, energy centers, and contractors. *ERA* also covers other energy information prepared *in report form* by federal and state government organizations, foreign governments, and domestic and foreign universities and research organizations. The user should remain aware that *ERA* coverage of non-report literature is limited to that generated by Department of Energy activity.

ERA is comprehensive in its subject scope, encompassing the DOE's research, development, demonstration, and technological programs resulting from its broad charter for energy sources, supplies, safety, environmental impacts, and regulation.

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ERA is available to the public on a subscription basis from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402. The subscription rate for the 24 semimonthly issues is $150.00 for domestic subscribers and $187.50 for foreign subscribers. A single issue costs $6.50 (domestic) or $8.15 (foreign). The cumulative indexes will be available in microfiche form only. The microfiche may be purchased from the National Technical Information Service, U. S. Department of Commerce, Springfield, Virginia 22161 and from Engineered Systems, P. O. Box 866, Oak Ridge, Tennessee 37830.

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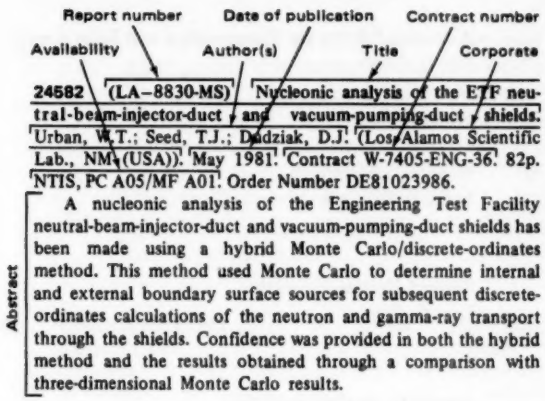
Report number
Date of publication
Contract number
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Author(s)
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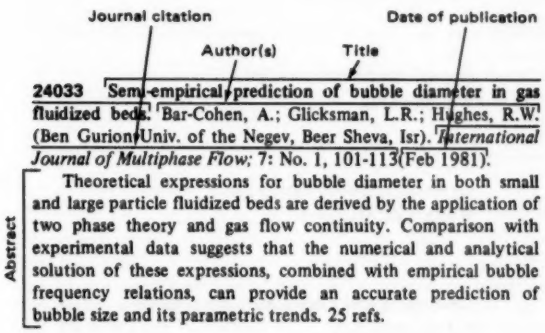
Corporate
24582 (LA–8830-MS) Nucleonic analysis of the ETF neutral-beam-injector-duct and vacuum-pumping-duct shields. Urban, W.T.; Seed, T.J.; Dudziak, D.J. (Los Alamos Scientific Lab., NM (USA)). May 1981. Contract W-7405-ENG-36. 82p. NTIS, PC A05/MF A01. Order Number DE81023986.
Abstract
A nucleonic analysis of the Engineering Test Facility neutral-beam-injector-duct and vacuum-pumping-duct shields has been made using a hybrid Monte Carlo/discrete-ordinates method. This method used Monte Carlo to determine internal and external boundary surface sources for subsequent discrete-ordinates calculations of the neutron and gamma-ray transport through the shields. Confidence was provided in both the hybrid method and the results obtained through a comparison with three-dimensional Monte Carlo results.


Journal citation
Date of publication
Author(s)
Title
24033 Semi-empirical prediction of bubble diameter in gas fluidized beds. Bar-Cohen, A.; Glicksman, L.R.; Hughes, R.W. (Ben Gurion Univ. of the Negev, Beer Sheva, Isr). International Journal of Multiphase Flow; 7: No. 1, 101-113 (Feb 1981).
Abstract
Theoretical expressions for bubble diameter in both small and large particle fluidized beds are derived by the application of two phase theory and gas flow continuity. Comparison with experimental data suggests that the numerical and analytical solution of these expressions, combined with empirical bubble frequency relations, can provide an accurate prediction of bubble size and its parametric trends. 25 refs.

• INDEXES TO *ENERGY RESEARCH ABSTRACTS*

Five indexes are provided for approaching the contents of each issue of *Energy Research Abstracts (ERA)*. Each index is preceded by an introduction that details the organization of the index and the principles by which it was compiled. The reader is referred to these introductions for information not found in the index examples that follow.

• Corporate Author Index

Technical report literature is indexed using the name of the organization or institution responsible for the issuance of the report.

24582 (LA–8830-MS) Nucleonic analysis of the ETF neutral-beam-injector-duct and vacuum-pumping-duct shields. Urban, W.T.; Seed, T.J.; Dudziak, D.J. **(Los Alamos Scientific Lab., NM (USA)).** May 1981. Contract W-7405-ENG-36. 82p. NTIS, PC A05/MF A01. Order Number DE81023986.

is indexed as:

Los Alamos Scientific Lab., NM (USA)
Nucleonic analysis of the ETF neutral-beam-injector-duct and vacuum-pumping-duct shields, 6:24582 (LA–8830-MS)

• Personal Author Index

Each author's name is indexed in the form appearing on the document abstracted, with the exception that given names are reduced to initials:

Bar-Cohen, A., Semi-empirical prediction of bubble diameter in gas fluidized beds, 7:24033
Dudziak, D.J., *See* Urban, W.T., 6:24582
Glicksman, L.R., *See* Bar-Cohen, A., 7:24033
Hughes, R.W., *See* Bar-Cohen, A., 7:24033
Seed, T.J., *See* Urban, W.T., 6:24582
Urban, W.T., Nucleonic analysis of the ETF neutral-beam-injector-duct and vacuum-pumping-duct shields, 6:24582 (LA–8830-MS)

• Subject Index

The subject index consisting of entries naming specific materials, objects, and processes is arranged alphabetically. Document titles or informative phrases, or both, specific to these entries are arranged alphabetically under the entries.

TOKAMAK ETF
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Nucleonic analysis of the ETF neutral-beam-injector-duct and vacuum-pumping-duct shields, 6:24582 (LA–8830-MS)

• Contract Number Index

DOE technical literature is indexed using contract numbers under which the literature was produced. This index contains the contract number with corresponding abstract and report numbers.

W-7405-ENG-36	**Los Alamos National Lab., NM (USA)**	
	6:24582	**LA–8830-MS**

• Report Number Index

Technical report literature is also indexed using report numbers. This index includes information on where individual reports may be obtained. Patents and conference papers are indexed here as a matter of convenience. When a report is supplied under an Order Number, that number is included in the availability statement. An Order Number-Report Number Correlation is included for convenience.

LA–		
8830-MS	**6:24582**	**NTIS, PC A05/MF A01. Order Number DE81023986, Distribution Category STD-20d**

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SUBJECT CONTENTS (NUMERICAL LISTING)

Six-digit subject category numbers are used in the storage, retrieval, and manipulation of bibliographic information entered into DOE's computerized bibliographic information system. The six-digit category numbers are utilized as if they were three pairs of two-digit numbers, the first two pairs being used to arrange the abstract content of *Energy Research Abstracts*. The following listing includes the totality of the 40 first-level and 294 second-level subject categories used. Because each issue of *ERA* announces only those documents becoming available during a semimonthly period, some subject categories may not be represented in every issue. The complete subject category scheme with scope notes is available as DOE/TIC-4584-R4 from NTIS for $7.00.

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SUBJECT CONTENTS (ALPHABETICAL LISTING)

Six-digit subject category numbers are used in the storage, retrieval, and manipulation of bibliographic information entered into DOE's computerized bibliographic information system. The six-digit category numbers are utilized as if they were three pairs of two-digit numbers, the first two pairs being used to arrange the abstract content of *Energy Research Abstracts*. The following listing includes the totality of the 40 first-level and 294 second-level subject categories used. Because each issue of *ERA* announces only those documents becoming available during a semimonthly period, some subject categories may not be represented in every issue. The complete subject category scheme with scope notes is available as DOE/TIC-4584-R4 from NTIS for $7.00.

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ENERGY RESEARCH ABSTRACTS

01 COAL AND COAL PRODUCTS

27629 (OTA-ISC—153, pp 79-108) **Soviet coal industry.** Nov 1981. NTIS, PC A18/MF A01.

In Technology & soviet energy availability.

The purpose of this chapter is to describe the current state and potential of the Soviet coal industry, including: 1) the characteristics of major coal deposits; 2) the technological and infrastucture problems facing the coal industry; 3) the degree of reliance of the Soviet coal industry on Western technology; and 4) the prospects for the industry in the next decade. The success of the Soviet coal industry seems to rest on the expansion of surface mining. Although the Tenth FYP sought to raise underground output, this actually fell by 23 mmt during the plan period, while surface mining production rose some 36 mmt and came closer to meeting its target. Unfortunately, however, Soviet surface-mined coal is often of poor quality. The prospects for the industry, therefore, strongly depend on the degree to which surface mining can be expanded and the success with which the coal thus mined can be treated, transported, and used. The survey of the major Soviet coal basins which follows provides the context for evaluating these two issues. (DMC)

0104 Processing

REFER ALSO TO CITATION(S) 27639, 27640, 27641, 27645, 27645, 27651, 27654, 27831

27630 **(DOE/ET/10586—T1) Experimental verification of a new technique for coal liquefaction. Final report.** Graboski, M.S. (Colorado School of Mines, Golden (USA)). 1977. Contract FG01-77ET10586. 50p. NTIS, PC A03/MF A01. Order Number DE82003620.

The importance of developing alternate technologies for converting coal to economically attractive synthetic fuels has recently been recognized. To this end, a new coal liquefaction scheme has been investigated. The basic idea behind this research was to investigate the use of microwave energy for the liquefaction of coal. Since thermal decomposition of the coal material proceeds through a free radical path, to maximize the yield of liquid and gas products, it is necessary to provide a chemically reactive hydrogen source. In this research, it was suggested that methanol would be suitable since it is capable of absorbing microwaves and thus being decomposed into reactive species which are capable of interacting with the coal. Additionally methanol is strongly imbibed by coal; therefore, a significant amount of methanol can be preadsorbed on the coal prior to microwave heating eliminating the mass transfer resistance associated with the contacting of the donor and coal during reaction. Finally, it was suggested that the reaction be carried out with the coal immersed in a non-microwave-adsorbing medium. The medium would act as a quench for the primary reaction products. The medium suggested in the proposal was liquid benzene. Based on the research, the following major conclusions were arrived at: (1) Coal can be decomposed in a microwave field to yield high quality liquid and gaseous products; (2) the process energy requirements are such that a reasonably high thermal efficiency is possible; (3) a vapor phase medium is better than a liquid phase medium due to a more efficient utilization of the microwave energy; (4) methanol is not a suitable hydrogen donor since it evaporates off the coal surface before thermal decomposition begins. Based on this research program, it is recommended that future work in the area of microwave liquefaction of coal be pursued.

27631 **(DOE/ET/14876—8) Catalysts for upgrading coal-derived liquids. Quarterly report, July 1-September 30, 1981.** Crynes, B.L. (Oklahoma State Univ., Stillwater (USA). School of Chemical Engineering). 29 Oct 1981. Contract AC22-79ET14876. 69p. NTIS, PC A04/MF A01. Order Number DE82004049.

Several catalysts were analyzed and the reactor EN-1 was redesigned to accommodate zonal bed experiments. In analysis of catalysts directed toward coke deactivation mechanisms, several observations were made: (1) coke accumulates rapidly during the first thirty hours of oil contact; (2) HDN and hydrogenations activities closely parallel the average coke content in the reactor bed; (3) pore size distributions of used catalysts remain the same shape as those of freshly sulfided catalysts; (4) the most frequent pore diameter decreases with increasing coke content; and (5) a linear relationship between pore volume and coke content was observed. In experiments to assess the effect of organic metals addition, titanocene dichloride added to the SRC oil resulted in reactor plugging. The coke content of spent catalysts revealed a linear relationship with titanocene addition. Nearly complete removal of the organometallic compound was achieved with accumulation observed by catalyst deposits and in the restricted sections the material of plugging.

27632 (DOE/PC/30026—4, pp 21-43) **Viscosity of H-coal samples. Final report.** Droege, J.W.; Taylor, D.R.; Chauhan, S.P. (Battelle Columbus Labs., OH). 30 Jun 1981. NTIS, PC A04/MF A01.

In Study of ebullated-bed fluid dynamics for H-coal. Quarterly progress report No. 4, April 1, 1981-June 30, 1981.

The rheological properties of 14 samples taken from the H-COAL pilot plant have been determined at temperatures up to 725 K (845 F), mostly at a pressure of 17.24 MPa (2500 psia) of hydrogen. The samples showed Bingham-plastic behavior. It was found that the properties were time-dependent in that the yield stress decreased to near zero. The rate of this change was higher at higher temperature. Most measurements were made without regard to this time dependency. Therefore, the results at the highest temperatures are somewhat in doubt for this reason.

27633 **(PB—81-858680) Protective coatings for gas turbines, power plants, and in coal gasification environments. January 1966-December 1980 (citations from the Metals Abstracts data base). Report for Jan 1966-Dec 1980.** (New England Research Application Center, Storrs, CT (USA)). Jan 1981. 66p. NTIS PC N01/MF N01.

This retrospective bibliography contains citations on the applications of protective coatings used in high temperature environments commonly encountered in gas turbine and coal gasification installations. These coatings include flame spraying, nickel-aluminum, ceramics, dispersion hardening, sputtered oxides, and thermal barrier coatings. (Contains 83 citations, fully indexed and including a table of contents.)

27634 **(PSI-TR—62) Modeling of coal gasification for fuel cell utilization. Quarterly progress report, May 1-August 1, 1976.** Lewis, P.F.; Simons, G.A.; Wray, K.L.; Finson, M.L. (Physical Sciences, Inc., Woburn, MA (USA)). Aug 1976. Contract AC03-76SF90396. 30p. NTIS, PC A03/MF A01. Order Number DE82004244.

This report describes the results of the first three months of effort on the development of a computational model for coal gasification processes to be used in conjunction with molten carbonate fuel cells. A preliminary identification of the requirements for optimum fuel cell operation is presented. A model is being developed for the gasification of an individual coal char particle. Particle burning experiments have been analyzed to determine the required

kinetic rates for desorption of carbon atoms from surfaces. Simple models have been used to estimate the mass transfer rates of reactant species into porous particles. Pressure-driven convection will prevail in the largest pores, and this process will generally not be limiting in comparison to surface burning rates. For micropores, Knudsen diffusion can easily be the limiting process, depending on pore size, particle size, and temperature. In summary, to optimize the molten carbonate cell efficiency we want the coal gasification off-gas composition to have a low partial pressure of CO_2, H_2O, H_2S and CH_4 and a yet to be determined optimum partial pressure of N_2. From cell lifetime considerations, the off-gas should have a low partial pressure of H_2S, minimal fly-ash content and probably a low hydrocarbon content. It seems that H_2 and CO are equally acceptable active fuels; if there is an optimum ratio, it is not known. But, it becomes clear that in the gasification process to be chosen there is no advantage in forcing the shift reaction to the right, nor is it desirable to produce CH_4.

27635 **(PSI-TR—72) Modeling of coal gasification for fuel cell utilization. Quarterly progress report, August 1-October 31, 1976.** Lewis, P.F.; Simons, G.A.; Wray, K.L.; Finson, M.L. (Physical Sciences, Inc., Woburn, MA (USA)). Nov 1976. Contract AC03-76SF90396. 21p. NTIS, PC A02/MF A01. Order Number DE82004243.

This report describes the results of the second three months of research on the development of a computational model for coal gasification processes to be used in conjunction with molten carbonate fuel cells. Optimum fuel cell operation has been identified to require low partial pressures of CO_2, H_2O, H_2S and CH_4. Entrained flow gasifiers appear to be most appropriate for producing these desired off-gas properties. A tentative working model has been constructed for the gasification of individual char particles. A kinetic rate model has been assembled for the dominant heterogeneous reactions involving carbon surfaces. Descriptions for the mass transort processes in porous char particles are given, and a solution has been derived for the combined problem of diffusion into the porous structure and reaction with the char material.

27636 **Numerical solution for gas-particle flows at high Reynolds numbers.** Laitone, J.A. (Univ of Mich, Ann Arbor). *American Society of Mechanical Engineers, [Paper]*; No. 81-WA;APM-10, 1-7(1981).

Predicting the fluid mechanical characteristics of a gas-solid two-phase flow is critical for the successful design and operation of coal gasification systems, coal fired turbines, rocket nozzles, and other energy conversion systems. This work presents a general grid-free numerical solution which extends a numerical solution of the Navier-Stokes equations developed by Chorin to a solution suitable for unsteady or steady dilute gas-solid particle flows. 14 refs.

27637 **Upgrading of short-contact-time solvent-refined coal.** Heck, R.H. (Mobil Research and Development Corp., Princeton, NJ); Mitchell, T.O.; Stein, T.R.; Dabkowski, M.J. pp 179-191 of Coal liquefaction fundamentals. Whitehurst, D.D. (ed.). Washington, DC; American Chemical Society (1980).

From 177. national meeting of the American Chemical Society; Honolulu, HI, USA (1 Apr 1979).

In solvent refining, coal is converted to a pyridine-soluble product after very short residence time at reaction conditions. The product formed in this short time is primarily a heavy high-melting point solid that contains most of the organic sulfur, nitrogen and oxygen of the original coal. In the SRC-I and SRC-II processes, this initial product is held at reaction conditions (~ 455°C and 13790 kPa) to achieve further defunctionalization and conversion to lighter products. A two-step process in which the coal is dissolved at short residence time, the ash and unreacted coal removed, and the resultant product catalytically hydroprocessed could have significant selectivity and activity advantages over a strictly thermal scheme. In this work, products from short-contact time dissolution were processed over a conventional $NiMo/Al_2O_3$ catalyst to determine the feasibility of the catalytic upgrading step in this two-stage liquefaction scheme. When compared to regular SRC, short residence time operation results in a decreased production of light liquids and gases and less hydrogen consumption; the solid product is more viscous and higher in sulfur and oxygen content than conventional SRC. The differences between regular and short-contact time SRC disappear rapidly with catalytic hydroprocessing of the latter. This processing yields an upgraded, low-sulfur boiler fuel and produces additional solvent for recycle or use as a light distillate fuel. A comparison of potential yields from a combined SCT dissolution plus upgrading scheme with yields from other liquefaction schemes shows that the SCT scheme has the potential to give significantly lower gas and higher liquid yields. This results in a more efficient utilization of hydrogen in the liquefaction process.

27638 **Processing short-contact-time coal liquefaction products.** Kulik, C.J.; Lebowitz, H.E.; Rovesti, W.C. (Electric Power Research Inst., Palo Alto, CA). pp 193-212 of Coal liquefaction fundamentals. Whitehurst, D.D. (ed.). Washington, DC; American Chemical Society (1980).

From 177. national meeting of the American Chemical Society; Honolulu, HI, USA (1 Apr 1979).

A considerable effort has been expended in attempts to better understand the mechanism by which coal is liquefied. From this work has emerged the concept of short residence time coal liquefaction which promises potential process advantages, small reactor, minimum hydrogen flow, and the efficient utilization of hydrogen for a particular product slate. This work, however, was limited, and indicated some very apparent process disadvantages: Process was out-of-solvent balance, a viscous reactor effluent was produced resulting in poor filterability, vacuum still bottoms had high viscosity, and the product was thermally sensitive. In order to overcome these problems, flow schemes incorporating Kerr-McGee Corporation's Critical Solvent Deashing and Fractionation Process (CSD) for recovery of the SRC were developed. The Kerr-McGee Process adds extra flexibility since this process can recover heavy solvent for recycle, which is not recoverable by vacuum distillation. EPRI contracted to have these process concepts tested on continuous bench-scale units. A complementary effort was made at the Wilsonville Pilot Plant under joint sponsorship by EPRI, DOE, and Kerr-McGee Corporation. This paper presents some of the initial findings. The quality of liquefaction solvent is an extremely important factor in liquefying coal at conventional or short residence time liquefaction conditions. The ability to alter the quality of this solvent by recycle of certain SRC fractions has made a marked improvement in liquefaction performance over a wide range of liquefaction severities. The implication of these findings as to a finalized overall process scheme has yet to be determined; however, this work supports the underlying process concept of being able to efficiently utilize hydrogen to produce a particular product slate. Further work is needed to substantiate these initial findings.

0106 Properties

27639 **(DOE/ET/10550—T1) Physical and chemical behavior of liquefied coal in solids separation. Second annual report for the year ending September 30, 1978.** Briggs, D.E.; Addington, D.V.; Brack, R.L. (Michigan Univ., Ann Arbor (USA). Dept. of Chemical Engineering). 1978. Contract AS01-76ET10550. 149p. (FE—2550-8). NTIS, PC A07/MF A01. Order Number DE82004537.

Annual progress reports for the following tasks are reported: (1) separation, characterization, and chemistry of liquefied coal; (2) solids separation-filtration experiments; (3) colloid chemistry of liquefied coal slurries; (4) adsorption characteristics of asphaltenes; (5) viscosity and surface tension characteristics of coal derived liquids. Some of the highlights for the year are: oxidative degradation of asphaltenes has shown promise for determining more about the aliphatic nature of the material; filter cake compressibility and effect of asphaltene concentration were determined for modal coal liquefaction slurries at 232°C; a sample of the liquefaction product from the H-Coal process was characterized as to chemical nature and filtration behavior; approximately 40 acids and bases were evaluated for their ability to reduce the viscosity of filtered H-Coal product oil; preliminary measurements by x-ray and laser light scattering techniques on a GPA fractionated asphaltene sample showed that the sample was not spherical in shape and was rather highly polydisperse; as little as 1% addition of asphaltenes to benzene, toluene, or tetralin increase the electrical conductivity of the solvents by two orders of magnitude; electrical deposition of asphaltenes from

solution is significantly influenced by hydrogen bonding characteristics of the solvent; initial viscosity studies shown Newtonian behavior for the oils and resins, asphaltenes, and preasphaltenes but strong shear thinning behavior for the unextracted H-Coal materials. (ATT)

27640 **(DOE/ET/10550—T2) Physical and chemical behavior of liquefied coal in solids separation. Quarterly report for the quarter ending December 31, 1978.** Briggs, D.E.; Cameron, J.R.; Ho, B.; Romine, J.C.; Smith, P.A.S.; Hillaker, G.; McKeen, J.A. (Michigan Univ., Ann Arbor (USA). Dept. of Chemical Engineering). 1978. Contract AS01-76ET10550. 53p. (FE—2550-9). NTIS, PC A04/MF A01. Order Number DE82004544.

A number of experiments were conducted with a preasphaltene fraction from the liquefaction of an Illinois No. 6 coal in the H-Coal process to determine the effect of the counter-ion of acids or bases in the isolation of asphaltene bases and acids. Elemental analyses were made on the various fractions and material balances made. A procedure was developed for the isolation and identification of the products from the Deno oxidation of asphaltenes. Viscosity measurements were made on synthesized model acids and bases at concentrations of 0.1M in THF. The compressibility of filter cake from the filtration at 232°C of H-Coal product oil slurries containing 20 wt % Soltrol 130 was found to be 0.55. Filtration experiments were conducted with five filter aids at 232°C. Celite 503 was the most effective. The specific cake resistance of cake from slurries containing 2 wt % Celite 503 was 17% of the resistance with out filter aid but little improvement resulted at higher concentrations. Small angle x-ray scattering was used to measure the radius of gyration of an asphaltene fraction at a concentration of 5.66 wt % in THF. The uncorrected radius of gyration was 18 A. Work was done to determine the adsorptive characteristics of the minerals kaolinite, bentonite, and quartz using linear elution adsorption chromatography. The retention volumes of xanthene on the three minerals were obtained and conclusions drawn. Viscosities were measured at different temperatures and shear rates for an oil and resin fraction and an asphaltene fraction. A slight shear thinning is observed in the oils and resins at 26 to 31°C, being more pronounced at the lower temperature. Mild shear thinning was observed in the asphaltene fraction at 123°C.

27641 **(DOE/ET/10550—T3) Physical and chemical behavior of liquefied coal in solids separation. Quarterly report, April-June 1979.** Briggs, D.E.; Cameron, J.R.; Islip, P.; Smith, P.A.S.; Ho, B.; Romine, J.C. (Michigan Univ., Ann Arbor (USA). Dept. of Chemical Engineering). Jul 1979. Contract AS01-76ET10550. 54p. (FE—2550-11). NTIS, PC A04/MF A01. Order Number DE82004541.

A technique was perfected for precipitating organic bases from THF solutions with phosphotungstic and phosphomolybdic acids. The procedure can be used to isolate the basic fraction of preasphaltenes. Nitrogen heterocycles can be removed from Deno oxidation products by formation and precipitation of the Reineckate salt of aromatic amines from aqueous acid solutions. The procedure was used to remove the heterocycles prior to esterification. BF_3 catalyzed esterification gave reproducible results on several coal derived liquids. The compressibility of filter cake produced from the filtration of H-Coal product oil was 1.14 compared to 0.55 when Soltrol 130 is added to give a slurry concentration of 20 wt % Soltrol 130 prior to filtration at 232°C. Small angle x-ray scattering experiments with GPC fractionated asphaltene samples indicate that the colloidal state of the asphaltene solution depends upon the nature of the homogeneous phase. For a high heteroatom content fraction in pyridine at 10 wt %, the micelles exist as a nominally monodisperse system with a radius of gyration of 14.8 A. In a mixture of 90 wt % tetralin, 2.5 wt % m-cresol and 7.5 wt % α-picoline at a concentration of 10 wt %, the same fraction is a polydisperse system with 98.5 of the micelles having a radius of gyration of 6.61 A and 1.50 wt % having a radius of gyration of 41.8 A or greater. An oil and resin fraction from the liquefaction of an Illinois No. 6 coal in the H-Coal process was subjected to oscillatory testing with the Weissenberg rheogoniometer to determine the viscoelastic properties of the fraction.

0108 Waste Management

REFER ALSO TO CITATION(S) 28131

27642 **(PB—81-156762) Environmental effects of western coal combustion. Part IV. Chemical and physical characteristics of coal fly ash. Final report.** Natusch, D.F.S.; Taylor, D.R. (Colorado State Univ., Fort Collins (USA). Dept. of Chemistry). Nov 1980. 218p. NTIS, PC A10/MF A01.

Coal fly ashes from different sources were extensively studied. Fly ash consists of as many as 12 different particle types, made up mainly of Si, Al, Ca, K, Na, and Fe. Many potentially volatile trace elements (As, Se, Ga, In, Pb, Cd) are always preferentially associated with more respirable particles. Many other minor and trace elements may also show an inverse particle size dependence, depending on the coal fly ash. Elements showing no dependence include Al, Ba, Ca, Co, Fe, K, Mg, Rb, Sc, Si, Ta, Ti, and the rare earths. Many of the more volatile and potentially hazardous trace elements are surface associated. Most potentially hazardous inorganic species in fly ash can be leached into aqueous solution but are unlikely to give rise to solution concentrations of great concern. The physical and chemical characteristics and behavior of polycyclic organic matter (POM) associated with coal fly ash was also studied. Theoretical models show that adsorption of POM on coal fly ash will occur in seconds in a typical emission stream and that the process is highly temperature dependent. Surface-adsorbed POM is highly reactive to some nitrogen and sulfur oxides at levels expected to be found in power plumes. It was found that some POM absorbed on fly ash are stabilized aganist photochemical decomposition, while other compounds decompose readily upon adsorption. Although fly ash emitted to the atmosphere contains much more POM than precipitator ash, there is an insufficient amount to make a discernible impact on any terrestrial aquatic system.

27643 **(PB—82-118670) Definitive SOx control process evaluations: aqueous carbonate and Wellman-Lord (acid, allied chemical, and resox) FGD (flue gas desulfurization) technologies. Final report Apr 78-Apr 81.** Byrd, J.R.; Anderson, K.D.; Tomlinson, S.V.; Torstrick, R.L. (Tennessee Valley Authority, Muscle Shoals, AL (USA). Div. of Energy Demonstrations and Technology). Jun 1981. 319p. NTIS, PC A14/MF A01.

The report gives results of economic evaluations of two processes: the Rockwell International aqueous carbonate process (ACP) and the Wellman-Lord process, the latter applied to a sulfuric acid plant, the Foster Wheeler Resox process, and the Allied Chemical coal reduction process, all for sulfur production. The ACP uses a spray dryer flue gas desulfurization (FGD) system and molten salt reduction with coal to make sulfur. For a 500-MW power plant burning 3.5% sulfur coal, capital investments for the ACP and the Wellman-Lord (acid, Resox, and Allied) processes are $119, $131, $138, and $141/kW, respectively. Annual revenue requirements are 4.81, 5.11, 6.03, and 5.94 mills/kWh, respectively. The ACP has a major cost advantage because it incorporates final fly ash and chloride removal as process functions. Fly ash removal credits and Wellman-Lord chloride control costs essentially determine the capital investment relationships of the processes. The ACP has a major advantage in annual revenue requirements because it does not need process or reheat steam. Wellman-Lord process costs are the same for all three applications. The cost difference results from end plant costs to produce acid or sulfur. The cost relationship could be affected by further development. The ACP, Resox, and Allied processes have not been operated as commercial FGD systems.

27644 **Method of increasing the sulfation capacity of alkaline earth sorbents.** Johnson, I.; Shearer, J.A.; Turner, C.B. (to Department of Energy). US Patent 4,312,280. 26 Jan 1982. Filed date 13 Mar 1980. vp.

PAT-APPL-129932.

A system and method for increasing the sulfation capacity of alkaline earth carbonates to scrub sulfur dioxide produced during the fluidized bed combustion of coal in which partially sulfated alkaline earth carbonates are hydrated in a fluidized bed to crack the

sulfate coating and convert the alkaline earth oxide to the hydroxide. Subsequent dehydration of the sulfate-hydroxide to a sulfate-oxide particle produces particles having larger pore size, increased porosity, decreased grain size and additional sulfation capacity. A continuous process is disclosed.

0109 Environmental Aspects

REFER ALSO TO CITATION(S) 27656, 27800, 27817, 28484, 28496, 28507, 28511, 28722, 28727

27645 (DOE/TIC—2002727) Environmental assessment of synfuels projects. Boston, C.R. (Oak Ridge National Lab., TN (USA)). 1980. Contract W-7405-ENG-26. 13p. NTIS, PC A02/MF A01. Order Number DE82002727.

The Oak Ridge National Laboratory is assisting the Department of Energy (DOE) in environmental assessments of synfuels demonstration projects. This activity includes the preparation of environmental impact statements for all six of DOE's demonstration plants. The synfuels technologies include high-Btu gasification, medium-Btu gasification and liquefaction.

27646 (PB—81-152530) Planning study to model and monitor coal pile runoff: Phase I. Final report, Jun 1979-Jul 1980. Brookman, G.T.; Ripp, J.A.; Katz, P.B.; Middlesworth, B.C.; Martin, D.K. (TRC Environmental Consultants, Inc., Wethersfield, CT (USA)). Feb 1981. 220p. NTIS, PC A10/MF A01.

The report describes a planning study for predicting and monitoring the hydrologic and chemical characteristics of effluent streams resulting from precipitation impacting on open storage of coal. It includes: a survey of utilities on storage habits and treatment systems for coal pile runoff, the development of a runoff model, a work plan to field test the model, and procedures for the field program. The survey includes information from 81 plants on size, shape, and handling practices for coal stocks and criteria used to design coal pile runoff treatment. The model developed in this program is in two sections: a hydraulic model TRCH20 and a quality model TRCCOAL. The model is capable of describing the surface and interior reaction in the coal pile as well as in the groundwater. A sensitivity analysis of several model parameters is also provided.

27647 (PB—82-120593) Pumped-slurry backfilling of abandoned coal mine workings for subsidence control at Rock Springs, Wyoming. Report BUMINES-IC-8846. Colaizzi, G.J.; Whaite, R.H.; Donner, D.L. (Bureau of Mines, Denver, CO (USA). Denver Research Center). Jul 1981. 107p. NTIS, PC A06/MF A01.

The Bureau of Mines, at the request of local authorities in Rock Springs, WY, investigated and conducted through contracts a multistage program of exploratory drilling and pumped-slurry backfilling of 15 areas of potential subsidence in abandoned mine workings underneath that community. Initially, the Bureau in 1969 had recommended a program of gravity blind flushing of some of the inaccessible mine voids, and in 1970 a new technique, the pumped-slurry injection process, was tested for the first time in a site adjacent to the city area of severe surface subsidence. Success of this initial testing program, and of a large-scale project in Scranton, PA, led to further large-scale projects, funded by Congress, that resulted in the successful backfilling not only of all 15 target areas of potential subsidence in Rock Springs, but also of several areas in other States. Total cost of the projects in Rock Springs, including the original pumped-slurry test, was $3,243,993. A total of about 923,000 tons of sand was injected hydraulically into mine voids, rendering 178 acres of residential and central-downtown areas of Rock Springs less susceptible to subsidence damage.

27648 Domestic coal firing in smokeless zones. Toynbee, P.A. (Coal Research Association of New Zealand (Inc.), Wellington). pp 892-911 of Residential solid fuels: environmental impacts and solutions. Cooper, J.A.; Malek, D. (eds.). Beaverton, OR; Oregon Graduate Center (1982).

From 1981 international conference on residential solid fuels; Portland, OR, USA (1 Jun 1981).

The New Zealand Clean Air Council, along the lines of its British counterpart, was established in 1972, devoted to the control of air pollution. It was empowered to declare Clean Air Zones but, in fact only one such zone has so far been established - in Christchurch where emission from domestic coal firing has always been an important issue. The paper describes the methods used for determining the emission of particulate matter, the criteria for acceptance in Clean Air Zones and the design of appliances which satisfy these criteria.

0120 Mining

REFER ALSO TO CITATION(S) 28146, 28147, 28148

27649 (DOE/ET/14242—T2) Investigation of problems and benefits of underground multiple seam coal mining. Final technical report. Singh, M.M.; Dunn, M.F. (Engineers International, Inc., Downers Grove, IL (USA)). Oct 1981. Contract AC01-79ET14242. 325p. NTIS, PC A14/MF A01. Order Number DE82002807.

It is estimated that over 156 billion tons of coal in the United States are amenable to multiple-seam mining. However, currently most operations mine only a single seam, and in the past indiscriminate practices have sterilized large amounts of coal in contiguous seams. In the interests of conservation, it is imperative that procedures be followed that enhance resource recovery. The total life-cycle costs of mining are site specific because of the wide variations in land acquisition costs, capital expenditures, resource recovery, labor productivity, and geological conditions. However, under similar circumstances the costs of single- and multiple-seam mining are within 5 percent, using the best available technology. Improvements in present methods could lower costs of multiple-seam mining further, making it more competitive. Ground control (entailing roof support, bumps, and subsidence) is the most important technical problem encountered in multiple-seam mining, mainly caused by remnant pillars. However, the nature and thickness of partings and overburden, as well as the type of floor, roof, and coal play a significant role. Ventilation control to prevent air leakage and gas accumulation, haulage difficulties because of floor undulations and roof falls, and fear of water inundation from an abandoned upper seam are other problems to be considered. Spontaneous heating may be experienced in some western coals. Changes in regulations that streamline permitting procedures and encourage multiple-seam mining need to be introduced. Union attitudes that permit better coordination between seams should be fostered. A research program addressing some of these problems is presented.

27650 (LBL—12100, pp 71-74) Advances in fossil energy: coal mine ventilation systems. McPherson, M.; Hood, M. Jul 1981. NTIS, PC A12/MF A01. Order Number DE82000804.

In Earth Sciences Division annual report 1980.

The present investigation seeks to determine those areas of coal mine ventilation in which research and development is most needed. The initial stages of the study have involved (1) a classification of literature in the field of mine environmental engineering over the past 5 years and (2) a series of interviews with individuals in industry, state organizations, and academic institutions who are working in this area. Preliminary classification of research areas in coal mine ventilation include: systems analysis; network analysis; economics and efficiency; district systems; environmental monitoring and control; dust; methane; heat; humidity; and spontaneous combustion.

0130 Transport And Handling

REFER ALSO TO CITATION(S) 27646

27651 (DOE/PC/30143—T4) Application of ultrasonic techniques to chemical coal cleaning processes. Final report, April 15, 1980-August 15, 1981. Tarpley, W.B. Jr.; Twesme, E.N.; Howard, P.L.; Moulder, G.R. (Energy and Minerals Research Co., Exton, PA (USA)). Aug 1981. Contract AC22-80PC30143. 52p. NTIS, PC A04/MF A01. Order Number DE82003093.

Ultrasonic activation was applied to several coal cleaning processes, including chlorinolysis, oxydesulfurization, and sodium hypochlorite leaching, in small-scale batch treatment processing of Illinois No. 6, Lower Kittanning, and Western Kentucky No. 11 coals. In all cases, ultrasonic energy application demonstrated effects that would translate in production to processing efficiencies and/or capital equipment savings. Specifically, in the chlorinolysis reaction, pyritic sulfur was removed 23 times faster with ultrasonics than without it. (Organic sulfur could not be removed from the coal examined with or without ultrasonics in the chlorinolysis process). In sodium hypochlorite leaching, the total sulfur extraction rate was 3 times faster with ultrasonics. Two separate benefits were seen with oxydesulfurization: ultrasonics doubled the reaction rate and at slightly accelerated rates allowed a pressure reduction from 960 to 500 psi, which would be a significant cost efficiency in production. With these results, it was recommended that ultrasonic processing be investigated with a process involving interactions similarly amenable to ultrasonic enhancement, i.e., molten salt leaching, which is reported to have the potential not only for more extensive sulfur extraction than the other experimental processes, but for ash removal as well.

0140 Combustion

REFER ALSO TO CITATION(S) 27800, 27817, 27943, 28229, 28231, 28237

27652 (PB—82-121328) Characteristics of coals for marine bunkering. Final report, 27 February-27 August 1981. Green, J.; Muir, W. (ESCA-Tech Corp., Costa Mesa, CA (USA)). Aug 1981. 143p. NTIS, PC A07/MF A01.

Forty-eight coal mines were studied relative to the use of coal as bunker fuel in marine boilers. The economic and technical suitability of coal for use as bunker fuel is determined by a number of factors such as rank of coal, cost of transportation, and combustion characteristics. The current price of coal varies according to its rank and method of transport. Mine mouth prices range from $6.50 to $34.00 per short ton in the western United States, $20.00 to $52.49 per short ton in the eastern United States, $10.82 to $25.02 for Australia, and $14.00 to $15.18 for South Africa. Transportation rates are generally applicable to railroads which carry the bulk of coal; less coal is shipped via barge and least by truck. The availability of coal bunkering facilities at ports is also a factor which controls shipping points, and demurrage rates. With the exception of Boston, all ports studied in this report either have existing or planned coal handling facilities.

27653 (PB—82-121567) Coal as a fuel for merchant ships. Report Y-ARD-2587/80. (Y-ARD Ltd., Glasgow (UK)). Mar 1980. 239p. NTIS, PC A11/MF A01.

The core of the report is the development of a coal-fired near-equivalent ship to the Panamax bulk carrier which was selected to form the basis of the study. The machinery for the coal-fired ship is discussed and financial comparisons are made. Fluidized-bed combustion is found to be technically feasible at sea. Coal-fired ships would not conflict with likely environmental requirements. At January 1978 prices of oil and coal the typical coal-fired ship was found not be viable on the routes examined. (But by 1980, the Foreword points out, the coal-fired ship would have a cost advantage on the postulated trading pattern.)

27654 (PNL—4100-Pt.4, pp 1-9) Reaction kinetics of combustion products. Feb 1982. NTIS, PC A06/MF A01.

In Pacific Northwest Laboratory annual report for 1981 to the DOE Office of Energy Research. Part 4. Physical sciences.

The goal of the Reaction Kinetics of Combustion Products program is to determine the conditions, mechanisms, and chemical reactions that control the identity and concentrations of emissions from coal combustion processes. Presently, the program emphasizes the investigation of the mechanism that forms organic pollutants during combustion. Mass spectrometric techniques have been developed for the study of the high-temperature kinetics relevant to coal combustion, with specific emphasis on techniques that will allow investigation of the mechanisms and rates of formation of toxic and carcinogenic organic compounds.

27655 Evaluation of emissions from residential coal-fired boilers under smokeless operation. Giammar, R.D. (Battelle Columbus Labs., OH). pp 304-312 of Residential solid fuels: environmental impacts and solutions. Cooper, J.A.; Malek, D. (eds.). Beaverton, OR; Oregon Graduate Center (1982).

From 1981 international conference on residential solid fuels; Portland, OR, USA (1 Jun 1981).

The results of two EPA programs, (1) Emissions from Residential and Small Commercial Stoker-Coal-Fired Boilers Under Smokeless Operation, and (2) Evaluation of Emissions and Control Technology for Industrial Stoker Boilers, suggest that coals can be burned in residential underfeed stokers in an environmentally acceptable manner. Reduction of emissions to acceptable levels can be achieved by applying state-of-the-art technology related to fuel modification and residential stoker design and operation. The first program indicated that volatile matter and free-swelling index were coal properties that can significantly influence emission levels. Data from the second program showed that the addition of limestone to high-sulfur coal was effective in reducing SO_2 emissions by 70 percent. To achieve this level of reduction, the mixture of limestone and coal were thoroughly mixed and extruded through a die to form a mechanically strong pellet. Thus, (1) processing a coal to reduce the volatile matter, which also reduces the free-swelling index, (2) adding limestone to this treated fuel and (3) extruding the mixture in pellet mill (or briquettes) can produce a fuel that can be burned cleanly in a residential stoker. Additionally, these programs indicated that simple changes in the design and operation of the stoker can significantly reduce emissions. Overfire air jets were installed above the retort to improve aerodynamic mixing in the combustion region of the bed. Also, data suggested that the emissions could be reduced by improved control of air introduction to the fuel bed achieved by the use of a two-speed fan and a timer-controller.

27656 Efficiency and emissions of a hand-fired residential coalstove. Macumber, D.W.; Jaasma, D.R. (Virginia Polytechnic Inst. and State Univ., Blacksburg). pp 313-332 of Residential solid fuels: environmental impacts and solutions. Cooper, J.A.; Malek, D. (eds.). Beaverton, OR; Oregon Graduate Center (1982).

From 1981 international conference on residential solid fuels; Portland, OR, USA (1 Jun 1981).

A new method of measuring the instantaneous, spatially-averaged stack-gas velocities of coalstoves (or woodstoves) has been developed. The method relies on simultaneous measurements of CO_2 concentrations in the stack and a collection system downstream of the stack. The real-time efficiency and SO/sub x/, NO/sub x/, and CO emissions of a hand-fired airtight coalstove have been measured using the technique. The fuel was a locally available bituminous coal. The stove was operated to give a burning rate of 1.3 kilograms per hour (12 kW). The average efficiency was 67% if chemical energy losses due to hydrocarbon and particulate emissions are neglected. The concomitant average emission factors for SO/sub x/, NO/sub x/, and CO are 3.4, 5.4, and 102 g/kg.

27657 Emissions from coal-fired residential combustion equipment. Hughes, T.W.; DeAngelis, D.G. (Monsanto Research Corp., Dayton, OH). pp 333-348 of Residential solid fuels: environmental impacts and solutions. Cooper, J.A.; Malek, D. (eds.). Beaverton, OR; Oregon Graduate Center (1982).

From 1981 international conference on residential solid fuels; Portland, OR, USA (1 Jun 1981).

This paper presents the results of a study to quantify criteria pollutants and characterize other atmospheric emissions from coal-

fired residential heating equipment. Flue gas was sampled from a warm air furnace and a hot water boiler which burned three western coals. Tests were conducted with the stokers operating on a 20-minute ON/40-minute OFF cycle, corresponding to high- and low-fire conditions in the fuel bed. Variations in coal composition and type of heating equipment both influenced emission rates, and the OFF portion of the heating cycle contributed significantly to total emissions. Combustion efficiencies for coal-fired residential heating equipment were lower than for larger coal-fired systems (e.g., utility boilers), as evidenced by the higher emission levels for CO and organic species, including POM's. In contrast to previous estimates, particulate emissions were not a function of the coal ash content, but did correlate with the coal volatile content. The particulate composition was primarily carbon, indicating that the particles were not formed from coal ash but from carbonaceous material volatilized during combustion.

27658 **United Kingdom efficiency tests and standards for residential solid fuel heating appliances.** Dickinson, R.; Payne, R.C. (National Coal Board, Stoke Orchard, England). pp 1055-1088 of Residential solid fuels: environmental impacts and solutions. Cooper, J.A.; Malek, D. (eds.). Beaverton, OR; Oregon Graduate Center (1982).

From 1981 international conference on residential solid fuels; Portland, OR, USA (1 Jun 1981).

Under an approval scheme operated by The National Coal Board for domestic coal and smokeless fuel fired heating appliances in the UK, laboratory tests by British standard methods ensure high standards of design, thermal efficiency and construction. Using a British standard laboratory open fire test, manufactured smokeless fuels are assessed gravimetrically to ensure acceptable levels of particulate emission. Field tests on smokeless fuels show that for appliances with full house heating capability, high levels of appliance efficiency are maintained over the range of typical domestic operation. For the UK market, running costs cheaper than for smokeless fuelled appliances are obtained by the use of efficient appliances designed to burn bituminous house coal with a high degree of smoke reduction. These designs utilize the principle of downdraught combustion and laboratory test methods ensure that particulate emissions from such appliances conform to the requirements of UK clean air legislation. Various approved designs of smoke reducing appliances have been marketed and experimental designs of high amenity are being developed.

0160 Health And Safety

REFER ALSO TO CITATION(S) 28035, 28707, 28708, 28709, 28710, 28711, 28717

27659 (PNL—4100-Pt.1, pp 3) **Mutagenicity of SRC materials.** Pelroy, R.A. Feb 1982. NTIS, PC A10/MF A01.

In Pacific Northwest Laboratory annual report for 1981 to the DOE Office of Energy Research. Part 1. Biomedical sciences.

Various coal liquids from the SRC-II Process were partitioned into genetically active and inactive materials by fractional distillation. Two sets of full-boiling-range SRC-II materials were fractionally distilled into boiling point (BP) cuts of 50°F or less. The BP cuts were subjected to a series of microbial screening tests: Salmonella typhimurium mutagenesis tests and Escherichia coli primary DNA damage. Only compounds in the full-boiling-range materials with BP of 650°F or above were active in the bioassay systems. (KRM)

02 PETROLEUM

27660 (OTA-ISC—153, pp 17-77) **Soviet oil and gas industry.** Nov 1981. NTIS, PC A18/MF A01.

In Technology & soviet energy availability.

This chapter attempts to elucidate the grounds of past US-Soviet controversies and illuminate present uncertainties. It examines the present condition of, and potential for, the Soviet oil and gas industries, with special emphasis on the impact of the West on oil and gas production. After a brief historical introduction it surveys the USSR's oil- and gas-producing regions. It then describes the state of each industry sector-exploration, drilling, production, transportation of oil and gas, refining, and offshore activities - including the past and potential contributions of Western equipment and technology. Finally, it summarizes the controversy over the future of Soviet oil production and posits plausible best and worst case estimates of oil and gas output for 1985 and 1990.

0201 Reserves

27661 **Alternative strategies for desert development and management.** Biswas, M.R.; Biswas, A.K. (eds.). Elmsford, NY; Pergamon Press (1982). 314p. (CONF-7705194—Vol.1). Pergamon Press, Inc., Maxwell House, Fairview Park, Elmsford, New York, 10523.

From International conference on desert development and management; Sacramento, CA, USA (31 May 1977).

The papers presented at the conference are published in 4 separate volumes. The conference was designed to study development opportunities in arid and desert zones and bring together the latest technology on desert development. Included in this volume were papers on renewable and mineral resources in arid regions, resource development strategies, and constraints to development. Separate abstracts have been prepared for items within scope for inclusion in the Energy Data Base. (DMC)

27662 **Occurrence of conventional oil and gas in desert aras.** King, R.E. pp 82-89 of Alternative strategies for desert development and management. Biswas, M.R.; Biswas, A.K. (eds.). Elmsford, NY; Pergamon Press (1982).

From International conference on desert development and management; Sacramento, CA, USA (31 May 1977).

This is no direct relationship between climates of the present day and relative oil and gas resources of different regions. However, in some major oil producing regions, notably the Persian Gulf, aridity prevailed through millions of years of geologic time, and a causal relationship probably existed. Many sedimentary basins in the interior of large continents are characterized by fluviatile and lacustrine deposits, with a deficiency in source rocks from which petroleum is generated. In some of the intracontinental sedimentary basins, there are considerable thicknesses of marine shale, sandstones, and limestones with high organic content. These are intercalated with or overlain by sedimentary rocks of predominantly terrestrial origin, and some of these have an excellent petroleum potential. In interior portions of some ancient gulfs, the sea water was brackish and the oil derived from sediments deposited in this environment is commonly very waxy, with a high pour point. This type of crude oil requires heating for pipeline and tanker transportation, and is more costly to exploit than normal crude oil. The petroleum prospects of some of the world's large deserts are reviewed, with emphasis on regions not presently containing large oil and gas fields. Oil has recently been found in rift basins in Chad, and similar basins in Niger and Mali, as yet little explored, may have interesting possibilities. The Hadramaut in South Yemen contains an inadequately tested deep basin. A large basin in southwestern Afghanistan is undergoing preliminary evaluation. Interior basins beneath the Iranian Plateau appear to have untested prospects. Large basins in northern and northwestern China contain some giant oil fields and they probably have a high potential for further discoveries. The coastal desert of Peru and northern Chile, though productive in the Talara district of northwestern Peru, has limited onshore prospects, but the offshore potential may be large.

0202 Geology And Exploration

27663 **Present state of geological cartography and mineral exploration in the Sahara.** Giraudon, R. pp 114-126 of Alternative strategies for desert development and management. Biswas, M.R.; Biswas, A.K. (eds.). Elmsford, NY; Pergamon Press (1982).

From International conference on desert development and management; Sacramento, CA, USA (31 May 1977).

The Sahara, in spite of difficulty of access, has been covered by aerial photographs for the largest part of its surface and by topographical mapping at a scale often as large as 1:200,000. Geological mapping at this comparatively accurate scale extends only over

some scattered patches, whereas the western and central parts have been surveyed at the scale of 1:500,000 and the eastern part at the scale of 1:1,000,000. Fostered by an oil potential which was suspected more than 30 years ago, geophysical surveys are of exceptional density when compared with the rest of Africa. The methods used have been mostly airborne magnetism and radiospectrometry. Mineral exploration has focussed only on substances of high unit value in areas not too remote from a seaport. The lack of transport, water supply, and availability of a qualified labour force are the main problems faced by mining ventures. The principal mineral output of the Sahara is iron ore, uranium, phosphates, copper and foremost, petroleum of which the Sahara is a major producing area in the world, and which has boosted the economic growth of countries where oil and gas fields have been discovered at an unprecedented rate. The Sahara is the largest desert in the world. It is 5500 kilometers long from the Atlantic to the Red Sea (including the Nubian Desert in the Sudan) with an average width of 1500 kilometers. Its maximum width is 2000 kilometers and the total surface area covers 8,000,000 square kilometers, which approximately equals that of the United States. This desert spreads over eleven countries: Algeria, Chad, Egypt, Libya, Mali, Morocco, Mauritania, Niger, Sudan, Tunisia and Western Sahara (formerly under Spanish administration).

0203 Drilling And Production

REFER ALSO TO CITATION(S) 28239

27664 **(DOE/BETC/3251—12) Measurement and correlation of conditions for entrapment and mobilization of residual oil. Final report.** Morrow, N.R. (New Mexico Inst. of Mining and Technology, Socorro (USA). New Mexico Petroleum Recovery Research Center; Department of Energy, Bartlesville, OK (USA). Bartlesville Energy Technology Center). Oct 1981. Contract AC03-79ET03251. 115p. NTIS, PC A06/MF A01. Order Number DE82003102.

Six tasks are reported: capillary number relationships for rock samples, residual oil saturation near wellbore, residual oil structure, effect of gravity on residual saturation, magnitude of residual oil saturation, and effects of wettability on capillary number relationships. (DLC)

27665 **Water requirements for petroleum production.** Bye, W.E. (Environmental Protection Agency, Washington, DC). pp 202-211 of Alternative strategies for desert development and management. Biswas, M.R.; Biswas, A.K. (eds.). Elmsford, NY; Pergamon Press (1982).

From International conference on desert development and management; Sacramento, CA, USA (31 May 1977).

The water requirements for Petroleum Production will be addressed under four distinct categories as follows: water use for personnel; water use for drilling muds; water use for enhanced oil recovery; and water use for associated processes. In water resources development project studies, it is essential that an industrial water base be established. That is, there must be a reasonable estimate formulated of the quantity of water used at the present time by each of the various categories of petroleum production. The best sources of information in making such a base study is the industry itself. The information relating to individual water uses was obtained from various reference sources using the most recent information available and a more or less complete census of industry sources.

27666 **Enhanced oil recovery.** Fayers, F.J. (ed.). Amsterdam, Holland; Elsevier Scientific Publishing Company (1981). 597p. (CONF-8109125—). Elsevier/North-Holland, Inc., 52, Vanderbilt Avenue, New York, NY 10017.

From 3. European symposium on enhanced oil recovery; Bournemouth, UK (21 Sep 1981).

This volume contains 29 of the 30 papers that were presented at the symposium on enhanced oil recovery which was held in the United Kingdom. These papers are grouped under the following categories: chemical flooding; miscible-gas displacement; numerical methods; experimental techniques; thermal recovery methods; United States research program. All of these papers have been abstracted and indexed. (ATT)

27667 **Fundamental aspects of surfactant-polymer flooding process.** Shah, D.O. (Univ. of Florida, Gainesville). pp 1-41 of Enhanced oil recovery. Fayers, F.J. (ed.). Amsterdam, Holland; Elsevier Scientific Publishing Company (1981).

From 3. European symposium on enhanced oil recovery; Bournemouth, UK (21 Sep 1981).

Surfactant-polymer flooding process offers a promising approach to recover additional oil from the water flooded reservoirs which may contain as much as 70% of original oil-in-place. The capillary number, which determines the microscopic displacement efficiency of oil, can be increased by 3 to 4 orders of magnitude by reducing the interfacial tension (IFT) of oil ganglia below 10^{-3} dynes/cm. Conceptual events involved in the mobilization and displacement of oil ganglia are described including the role of ultralow interfacial tension, the role of interfacial viscosity in coalescence of oil ganglia and formation of the oil bank, the propagation of the oil bank, the surfactant-polymer incompatibility, the formation and flow of emulsions in porous media, the role of wettability as well as the influence of surface charge density of the rock/fluid interface and oil-brine interface in oil displacement efficiency. It is shown that there are two regions of ultra-low IFT; (1) in the low surfactant concentration (0.1 to 0.2%) and the other in the high surfactant concentration region (2.0% to 10.0%). The surfactant-polymer incompatibility can lead to a phase separation of a surfactant and polymer even in the absence of oil. In the presence of oil, the formation of middle phase microemulsion is promoted by the presence of polymer in the aqueous phase. The surfactant-polymer incompatability is explained in terms of excluded volume effects and the maximization of solvent for polymer molecules.

27668 **Surfactants for enhanced oil recovery processes in high-salinity systems: product selection and evaluation.** Akstinat, M.H. (Technical Univ. of Clausthal, Germany). pp 43-62 of Enhanced oil recovery. Fayers, F.J. (ed.). Amsterdam, Holland; Elsevier Scientific Publishing Company (1981).

From 3. European symposium on enhanced oil recovery; Bournemouth, UK (21 Sep 1981).

Under consideration of high-salinity brines and different compositions of crude oils a standard test program for the rapid selection of surfactants was developed. By means of this program for testing surface-active products approximately 12 00 surfactants of different classes have been tested for their suitability as agents for enhanced oil recovery (EOR). From the results of these investigations, systematic correlations between chemical structure, product class and oil composition (naphthenic, aromatic, paraffinic) can be derived. Especially the properties of mixed surfactants (anionic-nonionic) are discussed in detail with respect to temperature dependent interfacial phenomena, sorption processes and chromatographic separation. The research work led to the surfactant classes of the Ethercarboximethylates and Ethersulfonates.

27669 **Preliminary studies of the behaviour of some commercially available surfactants in hydrocarbon-brine-mineral systems.** Andrews, C.; Colley, N.M.; Thaver, R. (British Gas Corp., London, England). pp 63-80 of Enhanced oil recovery. Fayers, F.J. (ed.). Amsterdam, Holland; Elsevier Scientific Publishing Company (1981).

From 3. European symposium on enhanced oil recovery; Bournemouth, UK (21 Sep 1981).

Some commercial surfactants have been studied with a view to their usefulness for enhanced oil recovery applications. The following aspects of their behaviour have been assessed. (1) Their interfacial tension behaviour with crude oil and pure alkanes. (2) The variation of phase inversion temperature with different variables. (3) Their adsorption onto rock surfaces. The interfacial tensions were measured by the spinning drop technique. As the temperature varies, the interfacial tension of a surfactant-brine-hydrocarbon mixture passes through a minimum. Some surfactants have given interfacial tensions approaching 10^{-3} dynes cm^{-1}. We have found: (1) the phase inversion temperature decreases with increasing salinity, the hydrocarbon and the surfactant concentration and composition remaining constant; (2) for constant salinity and surfactant concentration phase inversion temperature increases with increasing equivalent alkane carbon number; (3) the phase inversion temperature in-

creases with ethylene oxide content of the surfactant, salinity and hydrocarbon remaining constant; (4) the phase inversion temperature decreases with increasing lipophilic alcohol content of the systems; and (5) static adsorption tests on reservoir rock show Langmuir adsorption isotherms.

27670 **Provision of laboratory data for EOR simulation.** Brown, C.E.; Langley, G.O. (BP Research Centre, Sunbury-on-Thames, England). pp 81-100 of Enhanced oil recovery. Fayers, F.J. (ed.). Amsterdam, Holland; Elsevier Scientific Publishing Company (1981).

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Laboratory core tests are important in the development and assessment of EOR processes. It is vital that the core data obtained characterize the physical processes relevant to the field, and are appropriate to their use in field simulators. The key parameter of relative permeability is discussed, and its extension to low tension immiscible displacement assessed. The current status of these concepts is discussed with reference to oil slug propagation along a core.

27671 **Experimental study and interpretation of surfactant retention in porous media.** Novosad, J. (Petroleum Recovery Inst. Calgary, Alberta, Canada). pp 101-121 of Enhanced oil recovery. Fayers, F.J. (ed.). Amsterdam, Holland; Elsevier Scientific Publishing Company (1981).

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Total retention of surfactants in a reservoir during chemical floods is probably one of the most important parameters in that it determines the economic success or failure of this enhanced oil recovery process. It is not, therefore, surprising that a substantial research effort has been devoted to laboratory evaluations of surfactant retention in porous media. Generally, the systems studied are complex as they contain a minimum of two liquid phases, no less than five components: surfactant, cosurfactant, electroyte, water, and oil. The principal objective of this paper is to analyze and evaluate experimental procedures for determining surfactant adsorption and total surfactant retention. It is shown that the interpretion of experimental data is not straight forward, and that extreme caution must be exercised before any interpolation or extrapolation of adsorption or retention data is attempted. Laboratory data on retention of pure sulfonate (Texas # 1), petroleum sulfonate (TRS 10-80), and synthetic sulfonate (FA 400) are presented. These show the importance of experimental conditions as similar experiments may yield substantially different results when conditions are varied. Specifically, the effect of phase behavior on total surfactant retention is discussed and experimental procedures are outlined so that a differentiation can be made between losses of surfactant due to unfavorable phase behavior and those due to adsorption at the solid-liquid interface.

27672 **EACN of a crude oil: variations with cosurfactant and water oil ratio.** Tham, M.K.; Lorenz, P.B. (Bartlesville Energy Technology Center, OK). pp 123-134 of Enhanced oil recovery. Fayers, F.J. (ed.). Amsterdam, Holland; Elsevier Scientific Publishing Company (1981).

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The Equivalent Alkane Carbon Number (EACN) concept, which allows the substitution of a crude oil by an alkane or an alkane mixture for phase volume or interfacial tension studies, has been generally accepted. In this paper, it was shown that such parameters as alcohol type, crude oil composition, and water-oil-ratio could have an effect on the EACN of a crude oil. The partition behavior of the alcohol was traced as one of the causes for this aberration. Interaction of surfactant with heavy crude oil components was thought to be another. Experiments testing the later hypothesis is in progress.

27673 **Dynamic interfacial phenomena related to EOR.** Clint, J.H.; Neustadter, E.L.; Jones, T.J. (British Petroleum Co., Ltd., Sunbury-on-Thames, England). pp 135-148 of Enhanced oil recovery. Fayers, F.J. (ed.). Amsterdam, Holland; Elsevier Scientific Publishing Company (1981).

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The relevance of dynamic interfacial tension an interfacial rheology to EOR is discussed. A technique developed by BP, the Drop Volume Dynamic Tensiometer allows dynamic interfacial tension to be determined over a wide range of rate of fractional area change. The behaviour of aqueous surfactant systems against crude oil is very different for fresh systems compared with systems where the phases have been pre-equilibrated. The application of these measurements to EOR systems is illustrated with examples of surfactants which give widely different oil displacement profiles. A new method for the measurement of interfacial dilatational rheological parameters of oil/water interfaces is described. This is the pulsed drop experiment which has experimental advantages over the interfacial trough method and allows parameters to be determined over a wider range of frequencies. The effect of interfacial dilatational rheology on coalescence phenomena is illustrated with data for water-in-oil demulsifiers. The ease of oil bank formation is influenced by the kinetics of coalescence, which in turn is controlled by film drainage from between colliding droplets. For crude oil films in water, increasing interfacial shear viscosity greatly reduces the rate of thinning. For the reverse system, increasing interfacial shear viscosity can reduce coalescence rates for oil drops in water almost to zero. This would have a very adverse effect on oil bank formation.

27674 **Behavior of surfactants in EOR applications at high temperatures.** Handy, L.L. (Univ. of Southern California, Los Angeles). pp 149-160 of Enhanced oil recovery. Fayers, F.J. (ed.). Amsterdam, Holland; Elsevier Scientific Publishing Company (1981).

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Temperature sensitive properties of some anionic and nonionic surfactants used in EOR operations have been measured. Of particular interest is the thermal stability. Those surfactants we investigated decomposed by first order kinetics. The stability can, therefore, be quantitatively expressed in terms of the half-life of the surfactant. At 180°C half-lifes for petroleum sulfonates varied from 1 to 11 days. Activation energies were measured and these data can be used to predict half-lifes at other temperatures. Solubility of nonionics is known to be affected by temperature. At the cloud point they dehydrate and become less soluble. Anionics appear to form precipitates with rock minerals. This problem increases with increasing temperature. Adsorption is temperature dependent although the experimental results for the anionics were obscured by precipitation. Adsorption of nonionics were observed to decrease with increasing temperature at low concentrations but to increase with temperature at high concentrations. Interfacial tensions have also been measured as a function of temperature. The results vary with the surfactant. Mixtures of sulfonates, however, have all shown an order of magnitude reduction in interfacial tension at temperatures in excess of 120°C.

27675 **Surfactant slug displacement efficiency in reservoirs; tracer studies in 2-D layered models.** Wright, R.J.; Dawe, R.A.; Wall, C.G. (Imperial College, London, England). pp 161-178 of Enhanced oil recovery. Fayers, F.J. (ed.). Amsterdam, Holland; Elsevier Scientific Publishing Company (1981).

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The effects of layering within porous material with regard to basic flow mechanisms and chemical dispersion have been investigated. Experiments have been performed within unconsolidated glass bead packs. The variables controlled were layer permeability and dimensions, fluid viscosity and flow rate; gravity and capillary pressure influences were eliminated by using model fluids of matched density and complete miscibility. The importance of channeling and crossflow effects are emphasized by the results, and the behaviour of non-unit mobility ratio displacements is predictable using relatively simple conceptual/mathematical models. The dispersion of chemical tracers between layers has also been modelled mathematically and the results have been applied to laboratory tests on heterogeneous cores.

27676 Some aspects of the injectivity of non-Newtonian fluids in porous media. Vogel, P.; Pusch, G. (Technical Univ., Clausthal, Germany). pp 179-195 of Enhanced oil recovery. Fayers, F.J. (ed.). Amsterdam, Holland; Elsevier Scientific Publishing Company (1981).

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In existing numerical models, the rheological behaviour of polymer solutions is commonly described by the power law, which is not satisfactory at very low shear rates and at relatively high shear rates. An improvement of the mathematical description was achieved by using the Carreau viscosity equation and deriving a filter law for porous media. The validity over a wide range of shear rates was proven by experimental results obtained from flood tests in sand packs with one typical product each of the three polymer classes (PAA, HEC, BPS) used in enhanced oil recovery. On the basis of typical reservoir data, the behaviour of an injection well during polymer injection is investigated by calculating the pressure profile around a wellbore. From these data, conclusions are drawn for the selection of polymers according to their rheological properties.

27677 Basic rheological behavior of xanthan polysaccharide solutions in porous media: effects of pore size and polymer concentration. Chauveteau, G.; Zaitoun, A. (Institut Francais du Petrole, Rueil Malmaison, France). pp 197-212 of Enhanced oil recovery. Fayers, F.J. (ed.). Amsterdam, Holland; Elsevier Scientific Publishing Company (1981).

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The basic rheological behavior of xanthan polysaccharide solutions has been extensively investigated by varying polymer concentration, pore size and the chemical nature of porous media. The rheological characterization of solutions has shown that xanthan macromolecules behave like rigid rods in the salinity conditions selected. All microgels were carefully removed from solutions in order to study the behavior far away from injection wells. In fine cylindrical pores, mobility reduction at low shear rates was found to be constant and lower than the Newtonian viscosity at low shear rates, except for pore diameters smaller than macromolecule length. Water permeability was not reduced after polymer flow, showing that the rheological behavior was not influenced by retention or adsorption phenomena. The ratio between mobility reduction and relative viscosity decreases as pore size decreases and polymer concentration increases. This is explained by the existence near the pore wall of a depleted layer in which polymer concentration and thus viscosity is smaller than in the bulk. This depletion is due to steric effects and does not depend on chemical nature and pore shape. A model based on this physical hypothesis is proposed for calculating mobility reduction as a function of pore size and polymer solution properties. The model's predictions are in agreement with experimental results. In various unconsolidated porous media, such as packs of glass beads, carborundum particles and sand grains, the same behavior is observed. In all types of porous media, no dilatant behavior was detected even at the highest flow rates. The practical applications of this study for EOR are (1) xanthan solutions are better sweeping fluids in heterogeneous reservoirs than conventional fluids having the same average viscosity; (2) they can be used in less permeable formations than previously claimed; (3) very good injectability is expected for microgelfree solutions.

27678 Chateaurenard (France) polymer flood field test. Labastie, A. (Elf Aquitaine, Saint-Martory, France); Vio, L. pp 213-222 of Enhanced oil recovery. Fayers, F.J. (ed.). Amsterdam, Holland; Elsevier Scientific Publishing Company (1981).

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A polymer flood is operated by Elf Aquitaine in the Chateaurenard (France) field, located in the Paris Basin. The pilot is developed with one injector and seven producers, in a layer of unconsolidated sand, 5 meters thick, at a depth of 600 m; the 44 ha pattern encloses a very important pore volume (700,000 m3). The oil is paraffinic and has a viscosity of 40 cPo at reservoir temperature (30°C). The water being almost fresh (0,4 g/1 TDS) it has been decided to use hydrolyzed polyacrylamides. Several commercial products have been tested, mainly for viscosity and injectivity; a liquid polymer, dissolved in produced water, is presently being used for the pilot. The water must be carefully treated before dissolution to avoid polymer degradation and formation plugging. The injection has been started in 1977 and on account of the quantities injected so far, we have not yet seen any response in the six main producers (which are at a distance of 400 to 500 m from the injector). But the seventh intermediate producer, drilled at a shorter distance (280 m) from the injector, has shown very interesting results with a sharp decrease of the WOR (9000 tons of tertiary oil have been produced); this response is due to the effect of mobility control, maybe amplified by a local reservoir heterogeneity.

27679 Caustic flooding in the Wilmington Field, California laboratory, modeling, and field results. Breit, V.S. (Scientific Software Corp, Denver, TX); Mayer, E.H.; Carmichael, J.D. pp 223-236 of Enhanced oil recovery. Fayers, F.J. (ed.). Amsterdam, Holland; Elsevier Scientific Publishing Company (1981).

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The purpose of this pilot demonstration is to evaluate the efficiency of the caustic displacement mechanism in the environment of a stratified, heterogeneous, high oil viscosity reservoir where primary waterflood recovery is relatively poor. The test area is located in the Ranger Zone of Fault Block VII within the Wilmington Field. The pilot test involves the injection of caustic solution into a modified staggered line drive well pattern consisting of eight injection wells which surround eleven active producers in an area of approximately ninety-three acres. Laboratory investigations conducted jointly by THUMS and the Department of Oil Properties indicated that Ranger Zone crude could be readily emulsified in the presence of water containing as low as 0.1% by weight sodium hydroxide. Additional oil was recovered in core floods when 1.0 wt % sodium chloride was added to the alkaline solution. The results of the laboratory core test work and tests of the reaction between alkaline solutions and reservoir sands used in reservoir simulations indicated oil rate response and total incremental oil recovery are very dependent upon the caustic concentration and caustic slug size. Alkaline consumption calculated to be very large. This paper summarizes the results of the caustic core floods which were performed to evaluate the entrainment mechanism of oil displacement and laboratory tests to evaluate the long term consumption of hydroxide ions by the reservoir sands. The past performance of the field and the reservoir simulation history-match of that past performance are discussed. The predicted future performance of the field for both continued waterflooding and a caustic flood is summarized.

27680 Miscible displacement: its status and potential for enhanced oil recovery. Blackwell, R.J. (Exxon Production Research Co., Houston, TX). pp 237-245 of Enhanced oil recovery. Fayers, F.J. (ed.). Amsterdam, Holland; Elsevier Scientific Publishing Company (1981).

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Miscible flooding continues to be one of the most intriguing enhanced oil recovery methods because of its potential for recovering all of the oil flushed by solvent; and one of the most exasperating, because only in rare instances have actual field performances come anywhere close to the high recovery efficiencies potentially possible from this process.

27681 Theoretical aspects of calculating the performance of CO_2 as an EOR process in North Sea reservoirs. Huges, D.S.; Matthews, J.D.; Mott, R.E. (AEE Winfrith, Dorchester, England). pp 247-266 of Enhanced oil recovery. Fayers, F.J. (ed.). Amsterdam, Holland; Elsevier Scientific Publishing Company (1981).

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This paper examines some aspects of calculating the performance of CO_2 as a prospective enhanced oil recovery agent in North Sea reservoirs. The paper falls into two areas. First the problems of predicting the phase behaviour of CO_2 with reservoir oils are examined. Although experimental PVT data are available for CO_2-hydrocarbon systems, these are at lower pressures than prevail

in the North Sea. The Peng-Robinson and Generalized Redlich-Kwong equations of state are compared for existing experimental data, and their predictions for miscibility are reviewed for North Sea reservoir conditions. Some of the problems of pseudo-components and interaction coefficients are discussed in this context. Second, results are presented of 3-D compositional simulations for a simplified reservoir model based on the Forties Field. The few component equilibrium factors in this model are adjusted to match the equation of state implications discussed above. Current reservoir conditions are found to give an immiscible CO_2-displacement. Good sweep efficiencies are obtained in the watered-out reservoir from the immiscible CO_2-displacement calculations. This occurs because: (i) local displacement efficiency is good as a result of oil swelling and transfer of hydrocarbons into the gas stream and (ii) volumetric sweep is good with component exchange between gas and oil reducing viscosity and density differences. The reservoir pressure is then increased to achieve an MCM displacement. Three-dimensional results are obtained which compare the performance of the miscible and immiscible displacement processes. The immiscible results are slightly more attractive, but modelling approximations in both cases may be giving a false impression of the real comparability.

27682 **Oil recovery by carbon dioxide: the results of scaled physical models and field pilots.** Doscher, T.M.; El Arabi, M.; Gharib, S.; Oyekan, R. (Univ. of Southern California, Los Angeles). pp 267-283 of Enhanced oil recovery. Fayers, F.J. (ed.). Amsterdam, Holland; Elsevier Scientific Publishing Company (1981).

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Considerable efforts have been expended in the past decade on the potential use of carbon dioxide for the recovery of residual crude oil, however, the results of field pilot operations have indicated that very large quantities of carbon dioxide are required to recover the residual oil. Scaled physical model studies have been undertaken in an attempt to determine whether the large ratios of injected carbon dioxide to produced crude oil, observed in field demonstration projects, are to be expected or are due to some defects in the application of the process in the field. The results of this study have rather unequivocally indicated that the high ratios of injected carbon dioxide to recovered crude oil should in fact be expected. The experiments have also shown that a very heightened efficiency of the process can be achieved by using a slug of carbon dioxide followed by water. However, the results need to be qualified by noting that the prototype reservoirs used in these studies are very favorable for the use of CO_2. The recovery mechanism appears to be chiefly the solution of carbon dioxide in the oil, its swelling and consequent increase in mobility, and then the displacement of the swollen, mobile oil by a gas drive (if carbon dioxide is injected continuously) or by water if a slug of carbon dioxide is followed by the latter. The efficiency of the process is thwarted by the high mobility of the carbon dioxide which leads to viscous fingering and its low density, compared to water, which leads to gravity segregation. Experiments have indicated that nitrous oxide, which also displays a high solubility in organic compounds, is as effective as carbon dioxide in these model studies.

27683 **Laboratory testing procedures for miscible floods.** Sayegh, S.G.; McCaffery, F.G. (Petroleum Recovery Inst., Calgary, Alberta). pp 285-298 of Enhanced oil recovery. Fayers, F.J. (ed.). Amsterdam, Holland; Elsevier Scientific Publishing Company (1981).

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The objective of this paper is to provide a state-of-the-art review and critique of laboratory testing procedures for miscible flooding for researchers in the field. An additional aim of the paper is to give reservoir and production engineers insight into those procedures, so that they may appreciate their potentials and limitations, and be better able to evaluate laboratory results in light of their field experience. The topics treated include single- and multiple-contact phase behavior and physical properties measurements, and involve slim-tube and core displacement tests. General objectives for each type of test are listed, recommended practices are outlined, and many examples from the literature are referenced. In addition, general screening criteria are presented for the selection of suitable candidate reservoirs for miscible flooding. 70 references.

27684 **Complex study of CO_2 flooding in Hungary.** Doleschall, S. (Hungarian Hydrocarbon Inst., Szazhalombatta); Acs, G.; Farkas, E.; Paal, T.; Toeroek, J.; Balint, V.; Biro, Z. pp 299-311 of Enhanced oil recovery. Fayers, F.J. (ed.). Amsterdam, Holland; Elsevier Scientific Publishing Company (1981).

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A systematic program of carbonated natural gas flooding has been carried out in Hungary, based on laboratory PVT and displacement studies, followed by compositional mathematical simulation and field experiment on depleted reservoir. PVT studies have proved that gas containing 81 mole % carbon dioxide can be used for EOR purposes. The studies covered the volumetric and phase behaviour of carbonated natural gas flooding under field conditions and the results proved that such flooding was efficient even if the gas is not pure carbon dioxide. Based upon theoretical considerations a technological scheme has been developed to increase the sweep efficiency. A ten-component, three-phase mathematical model developed to simulate carbon dioxide flooding is suitable for treating single-and multi-phase systems. The difference equations handle the systems with different number of phases in a uniform way, thus the generation and disappearance of phases can be followed by the model without difficulties. The computer model was used to simulate partially miscible carbonated natural gas flooding in the western area of the Budafa oil field. The production history match and prediction agreed well with the field data.

27685 **Iterative method for phase equilibria calculations with particular application to multicomponent miscible systems.** Varotsis, N.; Todd, A.C.; Stewart, G. (Heriot-Watt Univ., Edinburgh, Scotland). pp 313-328 of Enhanced oil recovery. Fayers, F.J. (ed.). Amsterdam, Holland; Elsevier Scientific Publishing Company (1981).

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An equation of state based method is used to establish phase behaviour and properties for mixtures of injection gases and reservoir fluids with specific application to multicomponent miscible systems including CO_2. The modified Soave-Redlich-Kwong or the Peng-Robinson or a version of the Redlich-Kwong equation of state can be selected to be used in the model. The iteration method used requires a minimum number of variables for which simultaneous iteration is required and an algorithm based on the Broyden's modification of the full Newton step gives consistent phase properties and rapid convergence even near the very sensitive for a miscible displacement critical point area. The model has been tested against published data including simple binaries, ternaries and multicomponent mixtures of reservoir oil and CO_2 injection gases. Good agreement between the predicted and the experimental values has been found together with a minimum number of iterations required to solve each problem. The paper discusses briefly the specific use of the model in an experimental phase behaviour study for UK oil-CO_2 systems and as an integral part of a compositional reservoir simulator.

27686 **Phase equilibrium calculations in the near-critical region.** Risnes, R.; Dalen, V.; Jensen, J.I. pp 329-350 of Enhanced oil recovery. Fayers, F.J. (ed.). Amsterdam, Holland; Elsevier Scientific Publishing Company (1981).

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The present paper addresses the problem of phase equilibrium calculations in the critical point region. The approach is based on an equation of state, and both the Soave-Redlich-Kwong and the Peng-Robinson equations are considered. An accelerated and stabilized successive substitution method is presented. A procedure for disappearing phases is included making the method convergent also in the single phase region. The accelerated successive substitution method has been compared with Newton type methods like Powell's method. Maps of an error norm which measures the fugacity deviations, are presented to illustrate how the different solution techniques perform. The general conclusion is that the accelerated successive substitution method is faster and much more stable than the Newton type methods considered.

27687 Effect of simulated CO_2 flooding on the permeability of reservoir rocks. Ross, G.D.; Todd, A.C.; Tweedie, J.A. (Heriot-Watt Univ., Edinburgh, Scotland). pp 351-366 of Enhanced oil recovery. Fayers, F.J. (ed.). Amsterdam, Holland; Elsevier Scientific Publishing Company (1981).

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Both formation damage and stimulation effects have been experienced during miscible carbon dioxide field and laboratory tests in the USA. While the stimulation effects have been attributed to dissolution of the reservoir rock by carbon dioxide enriched flood water no work has been done to identify and quantify this phenomenon. Nor has any established theory for the formation damage been identified, although it seems likely that in some instances formation damage may be caused by formation fines, released by dissolution and subsequently migrating into pore throats. This paper describes a laboratory investigation into the effects of rock - fluid interaction under simulated reservoir conditions, and in particular the carbonated water - carbonate mineral reaction in sandstones during a CO_2 enhanced recovery process. The design and operation of experimental equipment for flowing CO_2-water mixtures through linear rock cores are described, together with the analytical methods used to assess changes in core characteristics. The paper presents results from initial tests on four different carbonate containing core materials.

27688 Computer modelling of EOR processes. Aziz, K. (Computer Modelling Group, Calgary, Alberta). pp 367-378 of Enhanced oil recovery. Fayers, F.J. (ed.). Amsterdam, Holland; Elsevier Scientific Publishing Company (1981).

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This paper presents a rather personal view of recent developments, current problems and future prospects for the computer simulation of enhanced oil recovery schemes. While substantial progress has been made over the past twenty years or so, some problems of significant practical importance remain unresolved.

27689 Three-dimensional numerical simulation of steam injection. Lemonnier, P. (Institut Francais du Petrole, Rueil Malmaison, France). pp 379-394 of Enhanced oil recovery. Fayers, F.J. (ed.). Amsterdam, Holland; Elsevier Scientific Publishing Company (1981).

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A three-dimensional thermal model has been developed for simulating both cyclic steam injection an steam drive. The numerical model TWIST describes three-phase flow (oil, water and steam) heat flow in the reservoir and heat conduction in the surrounding formations. Wellbore heat losses between the surface and the reservoir are taken into account. The various reservoir heterogeneities and temperature dependent parameters (including relative permeabilities) are considered. Distillation effects are approximated through the decreased residual oil saturation when steam is present. Mass conservation and energy equations are solved simultaneously to improve stability. A semi-implicit method is used for time formulation. The oil phase equation is decoupled with a scheme of the type p-T-S/sub g/S/sub w/. This formulation enables this thermal simulator to be very efficient in terms of computing time and stability. Numerical results are presented showing a steam stimulation history of five cycles and the influence of steam quality, initial reservoir pressure and steam injection rate on steamflood performance in a five-spot pattern.

27690 Special techniques for fully-implicit simulators. Appleyard, J.R.; Cheshire, I.M.; Pollard, R.K. (Atomic Energy Research Establishment, Harwell, Oxfordshire, England). pp 395-408 of Enhanced oil recovery. Fayers, F.J. (ed.). Amsterdam, Holland; Elsevier Scientific Publishing Company (1981).

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This paper addresses some problems which arise when a fully-implicit black oil simulator is allowed to take large time steps. It is shown that, by using a new form of time averaged relative permeability, it is possible to reduce time truncation errors to a very low level. The application of this technique also reduces the nonlinearities in the mass conservation equations which are solved at each time step. The solution of the linearized equations using iterative techniques becomes more difficult as the time step is increased. A new nested factorization algorithm for solution of these equations is described. The new method is shown to be more efficient than existing techniques on a set of 2D test problems. Experience with large 3D problems arising from North Sea applications has been most encouraging.

27691 Some considerations concerning the efficiency of chemical flood simulations. Foulser, R.W.S. (AEE Winfrith, Dorchester, England). pp 409-424 of Enhanced oil recovery. Fayers, F.J. (ed.). Amsterdam, Holland; Elsevier Scientific Publishing Company (1981).

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This paper discusses some aspects of improving computational efficiency and accuracy in surfactant flood calculations. The use of curvilinear grids in chemical flooding simulation can reduce grid orientation effects and speed up the calculations. For the low tension, low concentration surfactant processes being considered, the work of Martin and Wagner supports the application of conformal grids. The development at Winfrith of the PASL code, which applies the results of potential theory, has enabled suitable grid patterns to be generated for use in the CFTE code. This mesh generation code has also proved useful in visualizing flow patterns and consequent mesh requirements for studying possible pilot applications of surfactant flood under real reservoir conditions. A further improvement in the efficiency with which the CFTE code can be applied has been achieved by incorporating a line successive overrelaxation iterative solver (LSOR) into the code, as an alternative to the direct inversion method. Initially written for a scalar machine, its application on the CRAY vector machine has led to the development of alternative LSOR codes using different grid block orderings. These LSOR options run about twice as quickly as the direct inversion on the IBM scalar machine and, when vectorized on the CRAY, they run up to 65 times faster than the original code on the IBM. Thus the vectorized LSOR approach has proved to be very powerful.

27692 Control of numerical dispersion in compositional simulation. Wilson, D.C.; Tan, T.C.; Casinader, P.C. (Imperial College, London, England). pp 425-440 of Enhanced oil recovery. Fayers, F.J. (ed.). Amsterdam, Holland; Elsevier Scientific Publishing Company (1981).

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This paper presents a technique, suitable for multidimensional application, for reducing numerical dispersion on fully implicit compositional simulators. Simple geometrical analysis of curve profiles and re-examination of various weighting schemes lead to the development of a dynamic weighting technique that exploits the optimum features of 1-point, 2-point and mid-point weighting schemes. This weighting scheme is general in its application in finite difference models for reducing dispersion in convective parameters such as saturation and concentration. We show how this scheme can be implemented on an implicit, equation of state, compositional model. Numerical examples including multiple contact (MCM) and near miscible (NM) problems are used to compare its performance with two published compositional simulators which utilize full upstream weighting. Our results show a significant reduction in the number of grid blocks required to achieve the same numerical accuracy.

27693 Interphase mass transfer effects in implicit black oil simulators. Banks, D.; Ponting, D.K. (Atomic Energy Research Establishment, Harwell, Oxfordshire, England). pp 441-450 of Enhanced oil recovery. Fayers, F.J. (ed.). Amsterdam, Holland; Elsevier Scientific Publishing Company (1981).

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Mass transfer may be described in black oil simulators by allowing oil and gas to exist in both liquid and vapor phases. An efficient fully implicit method of simultaneously modelling bubble and dew point is described. A subtracted total gas formulation is found

to combine the advantages of the free and total gas approaches. A partial re-solution algorithm option is described which interpolates between total- and no-re-solution logic. The dispersion of dissolved gas and vaporized oil is discussed.

27694 **Novel device for CO_2 core flooding.** Meyn, V. (Inst. of Petroleum Engineering, Clausthal, Germany). pp 451-465 of Enhanced oil recovery. Fayers, F.J. (ed.). Amsterdam, Holland; Elsevier Scientific Publishing Co. (1981).

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A newly developed core flooding apparatus is described. The apparatus permits the conducting of flood experiments with living oil within a pressure range between 1 and 600 bar at flooding rates from 1 to 50 $cm^3.h^{-1}$. During the experiment, the mass flow of CO_2 at the input is held constant. The following data are thereby measured: oil production, water cut produced, number of moles of gas produced, gas chromatographical gas analysis up to C_7, analysis of stock tank oil up to C_{26}, pressure difference. Because the performance of core flooding experiments is feasible only within a certain length limit, whereas the development of the transition zone near the minimal miscibility pressure requires a flood distance of at least 1 m, a new experimental set-up has been tested. The flooding experiments are to be conducted with the transition zones previously established. This design is based on a publication by WATKINS. The establishment of the transition zone during the flood process is simulated in a three-stage mixing device, which consists of inclined pipes with a total length of about 6 m. The mixer was tested with oil from German oil reservoir. The concentrations of the components CO_2, as well as C_1 to C_{26}, were recorded gas-chromatographically at the output of the mixing device. With the help of these experiments, it can be demonstrated that such a mixer is capable of preparing a phase whose composition simulates that in the real transition zone, even in the vicinity of the minimal miscibility pressure.

27695 **Use of slim tube displacement experiments in the assessment of miscible gas projects.** De Bristowe, B.J.S. (British Petroleum Co., Ltd., Sunbury-on-Thames, England). pp 467-482 of Enhanced oil recovery. Fayers, F.J. (ed.). Amsterdam, Holland; Elsevier Scientific Publishing Co. (1981).

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Slim tube displacement experiments can be employed to optimize dynamic miscible displacement projects with respect to both pressure and composition. By analogy with the minimum dynamic miscibility pressure concept a minimum dynamic miscibility composition may be defined which may be used to assess the suitability of alternative injection gasses. Details are given of the way in which the slim tube displacement experiments are performed and are operated with automated data acquisition. Examples are provided of the phenomena observed during the course of the experiments which may be used to assess the nature of the displacement process. The results are discussed in relation to supercritical extraction phenomena which provides an explanation for the residual oil phase left behind in the slim tube at the end of the experiment.

27696 **Nuclear measurements of fluid saturation in EOR flood experiments.** Bailey, N.A.; Rowland, P.R.; Robinson, D.P. (AEE Winfrith, Dorchester, England). pp 483-498 of Enhanced oil recovery. Fayers, F.J. (ed.). Amsterdam, Holland; Elsevier Scientific Publishing Co. (1981).

From 3. European symposium on enhanced oil recovery; Bournemouth, UK (21 Sep 1981).

This paper describes the nuclear measurement methods which have been selected for the determination of fluid saturation distributions within the cores of high pressure flood experiments to be carried out at Winfrith in a study of enhanced oil recovery processes. Such methods should be capable of producing the accurate measurements of saturations, including their spatial and temporal variations, which are required to obtain a better understanding of the EOR process occurring within cores. It is intended that such measurements will provide a wider range of information for the validation of computer programs. These EOR codes are to be used for the assessment of the feasibility of EOR processes in North Sea Fields. A range of possible measurement techniques has been studied and the basis of the selection of the preferred nucleonic methods is described. The methods selected are based on the use of deuterium to determine water saturations or hydrocarbon gas components utilizing a gamma-neutron reaction, and the introduction of radioactive ferrocene as an additive to oil to measure oil saturation from gamma emission. The development work carried out to establish these nucleonic techniques is discussed in some detail, showing their clear potential, and the methods of application to high pressure core fluids are discussed. These techniques are currently being used in ongoing flood experiments.

27697 **Characterization of EOR polymers as to size in solution.** Dietz, R. (National Physical Lab., Teddington, England). pp 499-509 of Enhanced oil recovery. Fayers, F.J. (ed.). Amsterdam, Holland; Elsevier Scientific Publishing Co. (1981).

From 3. European symposium on enhanced oil recovery; Bournemouth, UK (21 Sep 1981).

The potential is explored of extending to the characterization of EOR polymers the conventional eletrical sensing zone (ESZ) technique. Theoretical expectations and experimental factors are discussed. The method is tested with well-characterized fractions of polyacrylamide and some biopolymer samples for which characteristics relevant to EOR use are known. Only the largest solution species can be detected, but those species are significant in determining technological properties. For polyacrylamides the ESZ response correlated with hydrodynamic volume. For biopolymers there were correlations with screen factor and with viscosity at concentrations of relevance in EOR. The method offers promise for monitoring solutions rapidly for microgel.

27698 **Visualization of the behaviour of EOR reagents in displacements in porous media.** Mahers, E.G.; Wright, R.J.; Dawe, R.A. (Imperial College, London, England). pp 511-526 of Enhanced oil recovery. Fayers, F.J. (ed.). Amsterdam, Holland; Elsevier Scientific Publishing Co. (1981).

From 3. European symposium on enhanced oil recovery; Bournemouth, UK (21 Sep 1981).

Micromodels have been successfully employed to observe directly displacement processes, and have assisted in understanding the physics of the complex fluid phenomena involved in Enhanced Oil Recovery. Both miscible and surfactant displacement sequences are reported here. The models have been produced by etching the pores into nylon, from which replicas in epoxy resin have been made. Computer graphics and microfilm facilities have been used to produce accurately drafted network photomasks.

27699 **Interplay between research and field operations in the development of thermal recovery methods.** Offeringa, J.; Barthel, R.; Weijdema, J. (Shell Production and Research Labs., Rijswijk, Holland). pp 527-541 of Enhanced oil recovery. Fayers, F.J. (ed.). Amsterdam, Holland; Elsevier Scientific Publishing Co. (1981).

From 3. European symposium on enhanced oil recovery; Bournemouth, UK (21 Sep 1981).

The role of research in the development of thermal recovery processes is discussed, viz: steam drive, steam soak, hot-water drive and in-situ combustion. The importance of feedback from field experience to research is pointed out. Five periods are distinguished: (1) early and mid-fifties when mainly laboratory work was carried out; (2) late fifties and early sixties when the processes were tested in field pilot projects; (3) mid-sixties to early seventies when large steam-soak projects were started and research experiments were carried out in large physical models; (4) mid-seventies to early eighties when the number of steam projects has been increasing fast, the design of these projects is being carried out with the aid of numerical simulators; and (5) the present, when new techniques and applications for thermal methods are under investigation. It appears from this historical survey that in particular the interplay between research and the field is stimulating for new developments.

27700 **US Department of Energy R & D on downhole steam generator for the recovery of heavy oil.** Fox, R.L. (Sandia National Labs., Albuquerque, NM); Stosur, J.J. pp 543-547 of Enhanced oil recovery. Fayers, F.J. (ed.). Amsterdam, Holland; Elsevier Scientific Publishing Co. (1981).

From 3. European symposium on enhanced oil recovery; Bournemouth, UK (21 Sep 1981).

The energy loss associated with delivering steam from surface generators to the reservoir is one of the factors that has limited most commercial steaming operations to relatively shallow oil bearing formations (about 1000 feet). The Sandia National Laboratories under contract to the US Department of Energy has initiated an ambitious program for the development and field testing of a downhole steam generator. The advantages are impressive: exceptionally high overall thermal efficiency; good potential for alleviating air pollution from generating steam at the surface, and; significant economic benefits from accelerated oil recovery due to the introduction of combustion products along with steam. Two designs are being developed: a low pressure and a high pressure steam generator. The low pressure combustion design transfers energy to water through a heat exchanger, thus enabling the combustion process to be conducted at a pressure less than the injection pressure; a high pressure combustion design mixes the combustion gases directly with water, resulting in the injection of steam and combustion gases into the reservoir. Field testing of a high pressure combustion generator was carried out in a shallow reservoir (275 meters) to determine if the system was compatable with field conditions, if recovery with this device resulted in modifications to the reservoir or produced crude, and to assess the injection of combustion gases into the formation as a method of reducing air pollution associated with steam injection. Follow on field tests have examined the performance of the device for downhole operations in reservoirs below 700 meters.

27701 **Steam drive - the successful enhanced oil recovery technology.** Doscher, T.M.; Ghassemi, F. (Univ. of Southern California, Los Angeles). pp 549-562 of Enhanced oil recovery. Fayers, F.J. (ed.). Amsterdam, Holland; Elsevier Scientific Publishing Co. (1981).

From 3. European symposium on enhanced oil recovery; Bournemouth, UK (21 Sep 1981).

Continued work with physically scaled models of the steam drive process has confirmed earlier conclusions that the process should be viewed as being comprised of two distinct components: the heating of the oil at the interface between the oil column and the overriding steam, and then the displacement of the heated oil by an exceptionally high velocity gas (steam vapor) drive. The studies described herein were conducted to validate certain hypotheses that result from the appreciation of the foregoing mechanism by which the steam drive operates. In general, all these hypotheses have been proven. The oil steam ratio, when communication between injection and producing wells is established early, is not dependent upon reservoir thickness when recovering moderately viscous crude oils. The oil steam ratios in a wide range of field operations, in keeping with this conclusion, are shown to fall within a very narrow band of values. Perhaps the most novel conclusion arising from this study, intimated by the work of others in the past, is that the steam drive is a powerful process for recovering high gravity crudes, even waterflood residuals if high injection rates of high quality steam can be achieved. The substitution of inert gas for some of the steam in a mature steam drive can significantly increase the thermal efficiency but it is not certain, at this time, that the economic efficiency would thereby be increased. Finally, the observed effect of the viscosity of the crude at steam temperature on the efficiency of the process threatens the possibility of using the steam drive for unassisted recovery of truly viscous crudes and bitumens.

27702 **Downhole steam generation using a pulsed burner.** Chesters, D.A.; Clark, C.J.; Riddiford, F.A. (BP Research Centre, Sunbury-on-Thames, England). pp 563-572 of Enhanced oil recovery. Fayers, F.J. (ed.). Amsterdam, Holland; Elsevier Scientific Publishing Co. (1981).

From 3. European symposium on enhanced oil recovery; Bournemouth, UK (21 Sep 1981).

The recovery of viscous crude oils using downhole steam generation provides a significant improvement in thermal efficiency over surface steam generation. It is also likely to be an economically viable solution for oil recovery at depths greater than 300m. In addition, by discharging combustion products into the formation, the technique is virtually pollution free and provides a source of CO_2 to assist viscosity reduction. The operation of a continuously fired, high intensity burner within the confines of an oil well, however, presents a number of technical problems, the most intractable of which relates to the selection of materials to operate at high burner temperatures. In order to obviate these difficulties BP has been developing a system based upon a pulsed burner. The unit operates in a quasi detonation mode and achieves the overall required combustion intensity as a series of high intensity, short duration pulses. Steam is produced by atomizing water into the high velocity combustion products, the quantity of steam being governed by ignition frequency and mixture flow rate. The feasibility of this system has been demonstrated on a 75 m test well. A high pressure test rig, designed to simulate oil well conditions at greater depths, has been built to test pulsed burners operating on both gaseous and liquid fuels. To date, operating experience on this scale has been obtained only on gaseous fuels. Under pulsating conditions, the temperatures on the combustion chamber walls are close to that of saturated steam at the operating pressure. Current developments are being directed towards liquid fuel operation, with the ultimate objective of proving a system on residual fuel.

27703 **Hot caustic flooding.** Janssen-Van Rosmalen, R.; Hesselink, F.T. (Shell Exploration and Production Labs., Rijswijk, Holland). pp 573-586 of Enhanced oil recovery. Fayers, F.J. (ed.). Amsterdam, Holland; Elsevier Scientific Publishing Co. (1981).

From 3. European symposium on enhanced oil recovery; Bournemouth, UK (21 Sep 1981).

A chemical recovery method used as a follow-up to or in combination with thermal methods is restricted to processes that are not too sensitive to elevated temperatures and temperature gradients. Caustic flooding is one of the few processes which can meet these requirements. Three different recovery mechanisms can be created by varying the salt content and/or adding extra chemicals to the caustic slug. The caustic process at high salinities is regarded to offer the best prospects for hot caustic, since the process does not require extra chemicals (e.g., polymer) for mobility control. In our studies on caustic floods, laboratory experiments have shown that an increase in temperature can be favorable for in-situ emulsification and, once an emulsion is formed, can drastically influence the flow properties of the emulsion. For a caustic flood following a hot water drive, a minimum shear rate was found to be necessary for emulsification. In the caustic flooding experiments where a mobile emulsion was formed, oil recoveries superior to those of a comparable hot-water flood have been obtained. In one-dimensional packs of reservoir sand a hot caustic flood recovered 16-18% PV additional oil after a hot water drive. The sweep-improving effects of a sufficiently mobile caustic emulsion are expected to give a substantially higher additional recovery in a real three-dimensional flood.

27704 **Enhanced oil recovery R & D in the United States and in the US Department of Energy.** Stosur, J.J.G. (Dept. of Energy, Washington, DC). pp 587-594 of Enhanced oil recovery. Fayers, F.J. (ed.). Amsterdam, Holland; Elsevier Scientific Publishing Co. (1981).

From 3. European symposium on enhanced oil recovery; Bournemouth, UK (21 Sep 1981).

The paper provides a general outline of the status of the enhanced oil recovery technology in the United States with emphasis on technical problems and the search for solutions. Upon this background, the US Department of Energy's effort and the research priorities in enhanced oil recovery are described including the new comprehensive data collection system and analysis on several hundred field projects.

0204 Processing

REFER ALSO TO CITATION(S) 27636

0206 Health And Safety

REFER ALSO TO CITATION(S) 28705

0207 Marketing And Economics

REFER ALSO TO CITATION(S) 27719, 28088, 28089, 28090, 28091

27705 (OTA-ISC—153, pp 311-322) **Soviet bloc and world energy markets.** Nov 1981. NTIS, PC A18/MF A01.

In Technology & soviet energy availability.

The prospect of a decline in Soviet oil production is addressed in this chapter. The potential impacts on both the West and Eastern block nations should the USSR or the Council for Mutual Economic Assistance (CMEA) become net oil importers are discussed. The most crucial factors are the ability of the USSR to substitute gas for oil in domestic consumption and the rate of construction of new pipelines for gas exports to the West. The ability of the CMEA to develop an energy policy which results in the better case conditions for substitution, demand, and economic growth will be as important as its ability to meet production targets in determining the degree to which CMEA's net hard currency energy balance will deteriorate. In the final analysis, oil and energy import problems must be viewed as critical threads in the fabric of CMEA economic viability. If the USSR and Eastern Europe together find it increasingly difficult to produce energy needed for both internal consumption and export earnings, it will be more difficult to sustain a growing economy. Regardless of which policy the Soviets pursue, the decline in net CMEA energy balances available for hard currency export by 1985 would probably have a far less significant effect on world energy markets than on the economies of the Soviet Union and its East European allies. (DMC)

27706 **(PB—81-151219) Gasoline demand in the Pacific Northwest. Interim report, 1 Sep 1979-31 Dec 1980.** DeRyke, R.; Falotico, R.; Fredrickson, J.; Johnson, S.; Lin, K. (Portland State Univ., OR (USA)). Oct 1980. 128p. NTIS, PC A07/MF A01.

This report is intended to lead to a better understanding of the nature of gasoline demand: its seasonality, responsiveness to price changes, and sensitivity to voluntary conservation programs. This paper also analyzes the impact of the Emergency Energy Conservation Act (EECA) on the Pacific Northwest.

27707 **(PB—82-116534) Petroleum operations of farmer cooperatives, 1979. Research report.** Bailey, J.M. (Agricultural Cooperative Service, Washington, DC (USA)). Jun 1981. 24p. NTIS, PC A02/MF A01.

The research updates the benchmark series of studies of United States farmer cooperatives' petroleum operations conducted in 1950, 1957, and 1969, comparing their findings with the latest 1979 figures for retail, wholesale, and refinery levels of operations as well as information on transportation equipment, storage facilities, and crude oil production and reserves. While cooperatives distributed at retail about 2% of the liquid petroleum used in the United States in 1979, they distributed about 43% of the petroleum farmers used in production of food and fiber.

27708 **Energy and the developing nations.** Auer, P. (ed.). Elmsford, NY; Pergamon Press Incorporated (1981). 522p. (CONF-800384—). Pergamon Press Inc., Maxwell House, Fairview Park, Elmsford, New York 10523.

From Electric Power Research Institute workshop on energy and the developing nations; Stanford, CA, USA (19 Mar 1980).

A separate abstract was prepared for each of 30 papers presented at the workshop. One paper was previously abstracted and cited in the Energy Data Base. (MCW)

0209 Environmental Aspects

REFER ALSO TO CITATION(S) 28543, 28544, 28704

27709 **(BLM-YK-ES—82-012-1792) Final environmental impact statement: proposed outer continental shelf oil and gas lease sale, Norton Sound.** (Bureau of Land Management, Washington, DC (USA)). Feb 1982. 560p. Dept. of the Interior, Washington, DC.

The statement discusses a proposal for oil and gas leasing in Norton Sound, alternatives to the proposal, major issues determined through the scoping process as well as staff analyses, and potential mitigating measures. The proposal consists of 429 blocks (approximately 2.4 million acres) to be offered for lease in Norton Sound, 14.4 to 99.2 kilometers (9 to 62 mi), 5 to 27 meters (16 to 89 ft). The probable impacts are based in part on the assumption that the mean resource estimate of 480 million barrels of oil would be discovered and produced in the proposed lease sale area. For this amount of oil, according to the USGS, 2.8 or about 3 oilspills exceeding 1000 barrels are probable over the 20-year production life of the oil field (Table IV.A.4.b.-1). There is only a 14-percent chance that commercial quantities of oil would be found or, in other words, an 86-percent chance of not finding oil. If no oil is discovered, of course, there is no risk from potential oilspills. The discussion assumes that all laws, regulations, and orders, are in place and are part of the proposal. If the mitigating measures described were adopted, it is expected that some impacts described in this environmental impact statement would be reduced. Potential effectiveness of the mitigating measures is described. Socio-economic factors are considered. Alternatives to the sale, including no sale, are evaluated.

27710 **(PB—81-803827) Biodeterioration of oil spills. 1964-February 1981 (citations from the NTIS Data Base). Report for 1964-Feb 1981.** (National Technical Information Service, Springfield, VA (USA)). Feb 1981. 145p. NTIS PC N01/MF N01.

The selected abstracts report on algae, bacteria, hydrocarbons, petroleum degradation, oil spills, beach cleanups, and microbial degradation as related to biodeterioration of oil spills. (This updated bibliography contains 136 citations, 5 of which are new entries to the previous edition.)

27711 **(PB—82-103474) Onshore impacts of offshore oil: a user's guide to assessment methods. Final report.** Williams, D.C.; Hom, K.B. (Williams (David C.) and Kathleen B. Hom, Washington, DC (USA); Department of the Interior, Washington, DC (USA)). May 1979. 72p. NTIS, PC A04/MF A01.

This User's Guide is designed to help public officials and others concerned with estimating and planning for (OCS) oil and gas impacts. It is a guide to recently developed OCS assessment methods. The User's Guide: tells how to select an OCS method to meet information assessment and planning needs; compares and contrasts the available methods according to several criteria important to state and local planners; describes the three principal planning and impact studies; introduces other relevant and potentially useful planning and impact studies; identifies opportunities in the OCS process to influence decisions.

27712 **Fishery-oil spill interaction model.** Reed, M.; Spaulding, M.L. (Univ of RI, Kingston). *American Petroleum Institute, Publication;* No. 4308, 63-73(1979). (CONF-7903164—).

From Oil spill conference: prevention, behavior, control, cleanup; Los Angeles, CA, USA (19 Mar 1979).

An oil spill behavior and fates model has been coupled to a fisheries model to produce dynamic simulations of the interactive effects between an oil spill and the cod fishery on Georges Bank, which impacts being projected into the commercial catch. Four trial cases are documented: spills occurring in December and April, with and without chemical treatment. Several systems problems are discussed, along with present and anticipated efforts to bring the set of models from its current preliminary state to one in which useful inferences may be drawn. 75 refs.

27713 **Cleanup of a 32,000-barrel crude oil spill at the West Hackberry dome storage site in Louisiana.** Wilson, J.E.; Gallagher, J. (DOE, Washington, DC). *American Petroleum Institute, Publication;* No. 4308, 437-440(1979). (CONF-7903164—).

From Oil spill conference: prevention, behavior, control, cleanup; Los Angeles, CA, USA (19 Mar 1979).

In 1978 a fire and major oil spill occurred at the U.S. Strategic Petroleum Reserve in West Hackberry, Louisiana. Five days later, the fire was extinguished, and within another two days more than 30,000 barrels of oil was recovered from an adjoining lake. An effective oil spill cleanup concluded the operation.

27714 **Oil spill treatment strategy modeling for Georges Bank.** Cornillon, P.C.; Spaulding, M.L.; Hansen, K. (Univ of RI, Kingston). *American Petroleum Institute, Publication;* No. 4308, 685-692(1979). (CONF-7903164—).

From Oil spill conference: prevention, behavior, control, cleanup; Los Angeles, CA, USA (19 Mar 1979).

A fates model has been developed which tracks both the surface and subsurface oil. The approach used to spread, drift, and evaporate the surface slick is similar to that in most other oil spill models. The subsurface technique, however, makes use of a modified particle-in-cell method which diffuses and advects individual oil/dispersant droplets representative of a large number of similar droplets. This scheme predicts the time-dependent oil concentration distribution in the water column, which can then be employed as input to a fisheries population model. In addition to determining the fate of the untreated spill, the model also allows for chemical treatment and/or mechanical cleanup of the spilled oil. With this capability, the effectiveness of different oil spill control and removal strategies can be quantified. 15 refs.

0210 Legislation And Regulation

27715 **(PB—81-117905) Compilation of laws related to mineral resource activities on the Outer Continental Shelf. Volume I.** (Bureau of Land Management, Washington, DC (USA)). Jan 1981. 298p. NTIS PC E03/MF A01.

This document, in two volumes, is a compilation of Federal laws which directly or indirectly relate to the OCS mineral program responsibilities of the Department of the Interior. Thirty-five laws, as amended, are included.

27716 **(PB—81-117913) Compilation of laws related to mineral resource activities on the Outer Continental Shelf. Volume II.** (Bureau of Land Management, Washington, DC (USA)). Jan 1981. 361p. NTIS PC E03/MF A01.

This document, in two volumes, is a compilation of Federal laws which directly or indirectly relate to the OCS mineral program responsibilities of the Department of the Interior. Thirty-five laws, as amended, are included.

0220 Transport, Pipelines, And Handling

REFER ALSO TO CITATION(S) 27707

0230 Properties

27717 **Novel anisole mixture and gasoline containing the same.** Singerman, G.M. (to Department of Energy). US Patent 4,312,636. 26 Jan 1982. Filed date 12 Nov 1980. vp. PAT-APPL-205224.

A novel anisole mixture containing anisole and a mixture of alkyl anisoles and liquid hydrocarbon fuels containing said novel anisole mixture in an amount sufficient to increase the octane number of said liquid fuel composition.

0240 Storage

REFER ALSO TO CITATION(S) 27713

03 NATURAL GAS

REFER ALSO TO CITATION(S) 27660

0301 Reserves

REFER ALSO TO CITATION(S) 27661

0304 Products And By-products

REFER ALSO TO CITATION(S) 27718

0306 Marketing And Economics

REFER ALSO TO CITATION(S) 27708

27718 **(NP—2902119) Overview of LNG operations.** Anderson, P.J.; Daniels, E.J. (Institute of Gas Technology, Chicago, IL (USA)). 8 Sep 1981. 56p. Inst. of Gas Tech., 3424 South State St., Chicago, IL 60616.

This paper reviews the economics of base-load LNG projects including prices, facilities, and components. Operations of existing base-load projects are reviewed in detail.

27719 **Oil and gas prospects in non-OPEC less developed countries.** Ehrlich, E.M. pp 13-33 of Energy and the developing nations. Auer, P. (ed.). Elmsford, NY; Pergamon Press Incorporated (1981).

From Electric Power Research Institute workshop on energy and the developing nations; Stanford, CA, USA (19 Mar 1980).

Liquefied natural gas production in non-OPEC less developed countries is discussed in this chapter. Data on recent oil and gas activities in selected countries are summarized. The appendix discusses projected oil production levels in the People's Republic of China. (DMC)

0308 Environmental Effects

REFER ALSO TO CITATION(S) 27709

0309 Artificial Stimulation

27720 **(SAND—81-1239) Multi-frac test series. Final report.** Schmidt, R.A.; Warpinski, N.R.; Finley, S.J.; Shear, R.C. (Sandia National Labs., Albuquerque, NM (USA)). Nov 1981. Contract AC04-76DP00789. 188p. NTIS, PC A09/MF A01. Order Number DE82004514.

This paper describes a series of five full-scale tests performed to evaluate various multi-frac concepts. The tests were conducted at the Nevada Test Site in horizontal boreholes drilled in ash-fall tuff from a tunnel under 1300 ft of overburden.

0300 NATURAL GAS

0310 Legislation And Regulation

REFER ALSO TO CITATION(S) 27715, 27716

04 OIL SHALES AND TAR SANDS

0401 Reserves And Exploration

27721 **Benefits and constraints of oil-shale and tar-sand development in arid areas.** Donnell, J.R. (US Geological Survey, Denver, CO). pp 72-81 of Alternative strategies for desert development and management. Biswas, M.R.; Biswas, A.K. (eds.). Elmsford, NY; Pergamon Press (1982).

From International conference on desert development and management; Sacramento, CA, USA (31 May 1977).

Desert areas of the world in the past have not fully benefited from the advances of modern science and technology. Discovery and development of the immense deposits of oil in the desert areas of the Middle East have led to the investigation of the possible existence of other commodities that might prove equally beneficial. Two of these commodities are tar sands and oil shale. The known world-wide resource potential of oil shale and tar sands is more than double that of petroleum. Although at present, oil is being produced commercially from tar sands only in Canada, and from oil shales only in the USSR and the Peoples Republic of China, the increasing demand for petroleum products and limited supply will probably necessitate the development of a synthetic fuels industry supplying oil from oil shale and tar sands. The large capital investment for a synthetic fuel industry requires a long period of time (20 or more years) to amortize the investment. This in turn requires a large in place resource to sustain an industry over the long term. In arid areas, only the United States contains a large enough tar-sands resource, and the United States and Morocco contain a large enough oil-shale resource to sustain the minimum size 50,000 barrel (7950 m^3) per day commercial development projected by US and Canadian industry. However, if a smaller scale (5000 to 10,000 barrels (795 to 1590 m^3) per day) industry is deemed to be economically feasible then arid areas of Israel, Jordan, Chile, and the USSR contain sufficient in place resources.

0403 Drilling, Fracturing, And Mining

REFER ALSO TO CITATION(S) 27720

0404 Oil Production, Recovery, And Refining

27722 **(AD-A—105667/0) Development of superior denitrogenation and isomerization catalysts for processing crude oil derived from shale. Part I. Final report.** Katzer, J.R.; Stiles, A.B.; Kwart, H. (Delaware Univ., Newark (USA). Center for Catalytic Science and Technology). 15 Aug 1981. 23p. NTIS, PC A02/MF A01.

For purposes of immediate application to shale oil, the most important conclusions derived from this preliminary work are the following: (1) As with quinoline, total nitrogen removal in multiring condensed heterocycled amines involves hydrogenation of the aromatic rings followed by (an often slower) process of C-N bond scission. (2) With multiring substrates of this nature the ring hydrogenation occurs more rapidly than the C-N bond scission reactions leading to the accumulation of considerable concentrations of hydrogenated nitrogen-containing species in the reaction mixture. (3) The overall rates of N-removal do not vary significantly because the rates of C-N bond scission in these hydrogenated species are quite similar. (4) The rates of these reactions would appear to be somewhat affected by steric hindrance to adsorption caused by the puckered cyclohexane rings and the similarity of rates must be due to the similarity of the steric effects.

0408 Marketing And Economics

REFER ALSO TO CITATION(S) 27721

0410 Enviromental Aspects

REFER ALSO TO CITATION(S) 28514, 28718, 28723

27723 **(LBL—13308) Application of molecular substituent parameters for the speciation of trace organometals in energy-related process fluids by element-selective HPLC.** Weiss, C.S.; Jewett, K.L.; Brinckman, F.E.; Fish, R.H. (Lawrence Berkeley Lab., CA (USA); National Bureau of Standards, Washington, DC (USA). Chemical and Biodegradation Processes Group). Nov 1981. Contract W-7405-ENG-48. 15p. (CONF-810588—5). NTIS, PC A02/MF A01. Order Number DE82003331.

From DOE/NBS workshop on environmental speciation and monitoring needs; Gaithersburg, MD, USA (18 May 1981).

High performance liquid chromatographic separations coupled with element-selective detectors provide trace molecular speciation methods applicable to energy-related process fluids and associated waste leachates. These materials present a challenge because they contain complex matrices whose chemistries are not well understood, and the processes have the potential to generate compounds containing toxic metals and metalloids that are either unexpected or have not been previously identified. Consequently, the ability to reliably ascertain the molecular structures of such unknown substances by relatively simple measurements of their chromatographic retention properties is very desirable. Our present work shows a linear correlation of the logarithm of the chromatographic capacity factor with the linear sum of the appropriate structural substituent parameters for a number of organoarsenicals, separated by an ion-exchange mechanism, and a number of organotins, separated by a hydrophobic mechanism. An illustration of the application of this linear free energy relationship as a diagnostic in the separation of trace organoarsenicals, by ion-exchange chromatography, was performed on the analysis of process waters from oil shale retorting and on leachates from raw oil shale.

05 NUCLEAR FUELS

REFER ALSO TO CITATION(S) 28007

0501 Reserves

REFER ALSO TO CITATION(S) 27661

27724 **Minerals in deserts.** Smith, G.I. (US Geological Survey, Menlo Park, CA). pp 90-97 of Alternative strategies for desert development and management. Biswas, M.R.; Biswas, A.K. (eds.). Elmsford, NY; Pergamon Press (1982).

From International conference on desert development and management; Sacramento, CA, USA (31 May 1977).

Almost any kind of mineral deposit can occur in desert areas, and the lack of vegetation and soil cover makes finding them easier. Some kinds of deposits, though, are more likely to occur in deserts than elsewhere. Some of these result from processes genetically related to the present desert climate that improved lower grade deposits of ore. One such process, termed secondary enrichment, is most effective in areas with deep water tables, and many low-grade copper, silver, and uranium deposits have been converted into mineable ore by the downward migration and redeposition of soluble metals. In a desert terrane, placer processes are effective whenever running water flowing over steep slopes erodes outcropping ore bodies and transports and concentrates the heavier ore minerals at lower levels, thus converting low-grade or hard-to-mine bedrock deposits into economically workable concentrations. Other kinds of deposits are better preserved in deserts because the lower rainfall at the surface, and the lower volume of flow and the greater depths to groundwater, result in less destruction of soluble ores; deposits of salines and phosphates are the most notable ores affected by these factors. Still other ore deposits are created as a consequence of the arid climate, mostly because the high evaporation rates operating on standing bodies of water produce brines that can lead directly to concentrations of salts and indirectly to secondary

minerals, such as zeolites, that are produced by reaction of silicate minerals with saline waters.

27725 **Recovery of metals and minerals in desert regions.** Bhappu, R.B. (Mountain States Research and Development, Tucson, AZ). pp 98-113 of Alternative strategies for desert development and management. Biswas, M.R.; Biswas, A.K. (eds.). Elmsford, NY; Pergamon Press (1982).

From International conference on desert development and management; Sacramento, CA, USA (31 May 1977).

Like any other part of the earth, nature has endowed the arid and semi-arid regions with valuable mineral resources. However, the difficulty of obtaining an adequate water supply at reasonable cost has hampered the development of mineral resources in these water-short areas. This paper is concerned with the dry and low-water consuming mineral processing and extractive technology currently available for recovering these mineral resources. The paper also covers potential extractive processes and techniques that could be used in the future and provides guidelines for education, research and development input necessary for extracting these mineral resources in the developing countries located in water-short areas.

0502 Exploration

27726 **(GJBX—390-81-Vol.2) Airborne gamma-ray spectrometer and magnetometer survey: Ukiah quadrangle, California.** (Bendix Field Engineering Corp., Grand Junction, CO (USA); Western Geophysical Co. of America, Houston, TX. Aero Service Div.). Apr 1981. Contract AC13-76GJ01664. 144p. NTIS, PC A07/MF A01. Order Number DE82005524.

Volume II contains the flight path, radiometric multi-parameter stacked profiles, magnetic and ancillary parameter stacked profiles, histograms, and anomaly maps for the Ukiah Quadrangle in California.

27727 **(GJBX—391-81-Vol.2) Airborne gamma-ray spectrometer and magnetometer survey: Weed quadrangle, California. Final report.** (Bendix Field Engineering Corp., Grand Junction, CO (USA); Western Geophysical Co. of America, Houston, TX. Aero Service Div.). May 1981. Contract AC13-76GJ01664. 188p. NTIS, PC A09/MF A01. Order Number DE82005523.

Volume II contains the flight path, radiometric multi-parameter stacked profiles, magnetic and ancillary parameter stacked profiles, histograms, and anomaly maps for the Weed Quadrangle in California.

27728 **(GJBX—405-81-Vol.2) Airborne gamma-ray spectrometer and magnetometer survey: Huron quadrangle, South Dakota. Final report.** (Bendix Field Engineering Corp., Grand Junction, CO (USA); Western Geophysical Co. of America, Houston, TX. Aero Service Div.). Apr 1981. Contract AC13-76GJ01664. 102p. NTIS, PC A06/MF A01. Order Number DE82005562.

Volume II contains the flight path, radiometric multi-parameter stacked profiles, magnetic and ancillary parameter stacked profiles, histograms, and anomaly maps for the Huron Quadrangle in South Dakota.

27729 **(GJBX—406-81-Vol.2) Airborne gamma-ray spectrometer and magnetometer survey: Alturas quadrangle, California. Final report.** (Bendix Field Engineering Corp., Grand Junction, CO (USA); Western Geophysical Co. of America, Houston, TX. Aero Service Div.). Apr 1981. Contract AC13-76GJ01664. 161p. NTIS, PC A08/MF A01. Order Number DE82005564.

Volume II contains the flight path, radiometric multi-parameter stacked profiles, magnetic and ancillary parameter stacked profiles, histograms, and anomaly maps for the Alturas Quadrangle, California.

27730 **(GJBX—407-81-Vol.2) Airborne gamma-ray spectrometer and magnetometer survey: Chico quadrangle, California. Final report.** (Bendix Field Engineering Corp., Grand Junction, CO (USA); Western Geophysical Co. of America, Houston, TX. Aero Service Div.). Apr 1981. Contract AC13-76GJ01664. 241p. NTIS, PC A11/MF A01. Order Number DE82005566.

Volume II contains the flight path, radiometric multi-parameter stacked profiles, magnetic and ancillary parameter stacked profiles, histograms, and anomaly maps for the Chico Quadrangle in California.

27731 **(GJBX—410-81-Vol.2) Airborne gamma-ray spectrometer and magnetometer survey: Susanville quadrangle, California. Final report.** (Bendix Field Engineering Corp., Grand Junction, CO (USA); Western Geophysical Co. of America, Houston, TX. Aero Service Div.). Apr 1981. Contract AC13-76GJ01664. 188p. NTIS, PC A09/MF A01. Order Number DE82005573.

Volume II contains the flight path, radiometric multi-parameter stacked profiles, magnetic and ancillary parameter stacked profiles, histograms, and anomaly maps for the Susanville Quadrangle in California.

27732 **(GJBX—411-81-Vol.2) Airborne gamma-ray spectrometer and magnetometer survey: Redding quadrangle, California. Final report.** (Bendix Field Engineering Corp., Grand Junction, CO (USA); Western Geophysical Co. of America, Houston, TX. Aero Service Div.). Apr 1981. Contract AC13-76GJ01664. 169p. NTIS, PC A08/MF A01. Order Number DE82005563.

Volume II contains the flight path, radiometric multi-parameter stacked profiles, magnetic and ancillary parameter stacked profiles, histograms, and anomaly maps for the Redding quadrangle in California.

0505 Enrichment

REFER ALSO TO CITATION(S) 27733, 27749, 27777, 28167, 28199

0507 Fuels Production And Properties

REFER ALSO TO CITATION(S) 27754, 27755, 27756, 27757, 27760, 27761, 27762, 27763, 27764, 27765, 27766, 27767, 27768, 27769, 27770, 27771, 27772, 27773, 27774, 27991, 28002, 28174, 28203

27733 (LA—8901-C, pp 39p, Session 11) **Elements of in-plant instrumentation design and implementation.** Oct 1981. NTIS, PC A99/MF A01.

From Advanced international training course on state systems of accounting for and control of nuclear materials; Santa Fe, NM, USA (27 Apr 1981).

This session will provide an overview of the important elements of in-plant NDA instrumentation design and a review of some implementation experience with general NDA techniques. The purpose of this session is to enable participants to: (1) identify key design elements of at-line and in-line instrumentation; (2) describe some limiting factors on instrument performance; and (3) discuss the in-plant application experience of several NDA techniques.

0508 Spent Fuels Reprocessing

REFER ALSO TO CITATION(S) 27733, 27752, 27759, 27760, 28002, 28029

27734 (LA—8901-C, pp 28p, Session 9) **Survey of bulk measurement technology and measurement standards.** Oct 1981. NTIS, PC A99/MF A01.

From Advanced international training course on state systems of accounting for and control of nuclear materials; Santa Fe, NM, USA (27 Apr 1981).

Bulk measurement is defined as it refers to nuclear material control and accounting and methods of performing bulk measurements and methods of calibration and certification of the various

measurements are described. The purpose of this session is to enable participants to: (1) define bulk measurement and the components that make up this concept; (2) define methods for measurement of volume, density, mass, and pressure necessary to perform bulk measurements; (3) describe standards and control programs for analytical methods used in bulk measurement; (4) define a system of national standards; and (5) define techniques for using national standards to calibrate and certify plant measurement systems. There are two types of facilities that handle nuclear materials. There are a bulk-handling facility and an item-handling facility. A bulk-handling facility is one that handles or processes nuclear material in nondiscrete quantities either by batch or continuous processes. Examples of bulk-handling facilities include enrichment plants, reprocessing plants, and fuel-fabrication plants. Item-handling facilities include reactors and nuclear material storage facilities. (DMC)

0509 Transport And Storage

REFER ALSO TO CITATION(S) 27739

27735 **(HEDL-SA—2484-FP) High temperature post-irradiation performance of spent pressurized-water-reactor fuel rods under dry-storage conditions.** Einziger, R.E.; Atkin, S.D.; Stellrecht, D.E.; Pasupathi, V. (Hanford Engineering Development Lab., Richland, WA (USA); Battelle Columbus Labs., OH (USA)). Jun 1981. Contract AC06-76FF02170. 48p. NTIS, PC A03/MF A01. Order Number DE82003780.

Post-irradiation studies on failure mechanisms of well characterized PWR rods were conducted for up to a year at 482, 510 and 571°C in unlimited air and inert gas atmospheres. No cladding breaches occurred even though the tests operated many orders of magnitude longer in time than the lifetime predicted by Blackburn's analyses. The extended lifetime is due to significant creep strain of the Zircaloy cladding which decreases the internal rod pressures. The cladding creep also contributes to radial cracks, through the external oxide and internal FCCI layers, which propagated into and arrested in an oxygen stabilized α-Zircaloy layer. There were no signs of either additional cladding hydriding, stress-corrosion cracking or fuel pellet degradation. Using the Larson-Miller formulization, a conservative maximum storage temperature of 400°C is recommended to ensure a 1000-year cladding lifetime. This accounts for crack propagation and assumes annealing of the irradiation-hardened cladding.

27736 **(NUREG/CR—2037) Transportation of radioactive material in Washington state. Transportation surveillance study Sep 79-Sep 80.** (Washington State Dept. of Social and Health Services, Olympia (USA). Health Services Div.). Sep 1981. 40p. NTIS, PC A03/MF A01.

The report describes a one-year study by the State of Washington of the transportation of radioactive material in Washington, during the period, September 9, 1979 to September 8, 1980. Shipments of low-level radioactive waste into the Nuclear Engineering Company disposal facility near Richland, Washington were surveyed continuously to determine the origin of such wastes, types and conditions of packages and transport vehicles, and compliance with relevant regulations. The number of violations that were uncovered decreased during the course of the study indicating an increase in the awareness of shippers and carriers to pertinent regulations. Most of these violations were minor in nature. Radioactive material shipments were monitored at several seaports and airports in Washington State. Personnel and area monitoring with thermoluminescent dosimeters (TLD's) at these facilities showed no significant radiation exposure or radionuclide contamination problems.

27737 **Investigations of heat removal from storage systems for transport containers of spent fuel elements.** von Heesen, W; Malmstroem, H. (STEAG A.G., Essen (Germany, F.R.)); Detzer, R.; Loew, W. (Kessler und Luch G.m.b.H., Giessen (Germany, F.R.)); Kloepper, H. (Deutsche Gesellschaft fuer Wiederaufarbeitung von Kernbrennstoffen m.b.H. (DWK), Hannover (Germany, F.R.)). pp 307-310 of Jahrestagung Kerntechnik '81 - Reaktortagung 1981. Tagungsbericht. Sektion 4: Brennstoffkreislauf und Spaltstofflusskontrolle. Eggenstein-Leopoldshafen, Germany, F.R.; Fachinformationszentrum Energie, Physik, Mathematik (1981).

From Annual meeting on nuclear technology; Dusseldorf, F.R. Germany (24 Mar 1981).

0520 Waste Management

REFER ALSO TO CITATION(S) 27735, 27777, 28002, 28534, 28744, 28746

27738 (LBL—12100, pp 52-53) **Database of chemical properties of nuclear waste elements in aqueous solutions.** Phillips, S.L.; Igbene, A. Jul 1981. NTIS, PC A12/MF A01. Order Number DE82000804.

In Earth Sciences Division annual report 1980.

A program has been initiated at Lawrence Berkeley Laboratory (LBL) to evaluate critically the existing data on the basic properties of nuclear waste elements in order to predict the effects of their long-term isolation in the geologic environment. The objective of the program is threefold: (1) to make a critical survey of the currently available published data and theory of the thermodynamic and physical properties of selected nuclear waste elements in order to identify significant research gaps; (2) to tabulate experimental values, theoretical equations, and recommended values for each property and selected waste element; and (3) to utilize modern computer methods for handling bibliographic references and calculating numerical data.

27739 **(NVO—196-26) Nevada nuclear waste storage investigations. Quarterly report, April-June 1981.** (Department of Energy, Las Vegas, NV (USA). Nevada Operations Office). Aug 1981. 78p. NTIS, PC A05/MF A01. Order Number DE82004722.

The Nevada Nuclear Waste Storage Investigations (NWSI) are oriented toward developing or improving the technology of nuclear waste storage and disposal and determining whether selected underground rock media on or adjoining the Nevada Test Site are technically acceptable for a licensed, permanent, high-level nuclear waste repository. The NNWSI Project Work Breakdown Structure for FY 1981 is comprised of the following eight tasks: systems; waste package; site; repository; regulatory and institutional; test facilities; land acquisition; and program management. Some of the highlights for this quarter are: initial screening studies of candidate waste package alloys in tuff groundwater have been completed; installation of the Constant Air Monitoring System and the Remote Area Monitoring System was completed at the E-MAD Facility; a transport model for describing the potential behavior of radionuclides in tuff was developed; a diaphragm diffusion cell was constructed for directly measuring the diffusion properties of tuff; a report was completed on the mineralogy and petrology of the 6000-foot section of the first major exploratory stratigraphic hole at Yucca Mountain; a series of numerical experiments have been conducted to employ nuclear explosions and earthquake data in a simultaneous inversion for crustal velocities and station delays to improve the accuracy of earthquake location; a three-dimensional material model was developed for predicting jointed rock-mass response.

27740 (PNL—4100-Pt.2, pp 145) **Assessment of Effectiveness of Geologic Isolation Systems.** Soldat, J.K.; Napier, B.A. Feb 1982. NTIS, PC A08/MF A01.

In Annual Report for 1981 to the DOE Office of the Assistant Secretary for Environmental Protection, Safety, and Emergency Preparedness. Part 2. Ecological Sciences.

The program for Assessment of Effectiveness of Geologic Isolation Systems (AEGIS) is managed through Pacific Northwest

Laboratory's Water and Land Resources Department and is funded through the Battelle Office of Nuclear Waste Isolation (ONWI). The Ecological Sciences Department was involved in two subtasks under AEGIS: Dose Methodology Development and Reference Site Initial Analysis (RSIA) for a Salt Dome.

27741 (PNL—4100-Pt.2, pp 147) **Hanford Defense waste studies.** Napier, B.A.; Watson, E.C. Feb 1982. NTIS, PC A08/MF A01.

In Annual Report for 1981 to the DOE Office of the Assistant Secretary for Environmental Protection, Safety, and Emergency Preparedness. Part 2. Ecological Sciences.

PNL is assisting DOE in preparation of a programmatic environmental documentation on the potential strategies for managing Hanford Defense nuclear waste. The Ecological Sciences Department is performing the subtasks of developing guidance on allowable amounts of residual environmental contamination and calculating potential public health and safety impacts from proposed operations.

27742 (PNL—4100-Pt.2, pp 153) **Standardized input for Hanford environmental impact statements.** Mueller, M.A.; Jamison, J.D.; Napier, B.A. Feb 1982. NTIS, PC A08/MF A01.

In Annual Report for 1981 to the DOE Office of the Assistant Secretary for Environmental Protection, Safety, and Emergency Preparedness. Part 2. Ecological Sciences.

The DOE Waste Management Program has required that environmental impact statements (EIS) be prepared for a variety of waste management activities at the Hanford site. These EISs are prepared in accordance with the Council on Environmental Quality (CEQ) and DOE guidelines by several different lead contractors. The objective of this project, sponsored by the DOE Waste Management Program, is to reduce redundancy of effort and promote uniformity in EISs by preparing standardized sections and methods that are acceptable to DOE's Richland Operations Office and the Hanford contractors.

27743 (PNL—4100-Pt.2, pp 159) **Preliminary radiation dose analysis for reference FUSRAP waste sites.** Kennedy, W.E. Jr.; Aaberg, R.L. Feb 1982. NTIS, PC A08/MF A01.

In Annual Report for 1981 to the DOE Office of the Assistant Secretary for Environmental Protection, Safety, and Emergency Preparedness. Part 2. Ecological Sciences.

The purpose of this study is to provide Bechtel National at Oak Ridge, Tennessee, with a preliminary radiation dose analysis of buried radioactive waste for the formerly utilized site remedial action program (FUSRAP). Bechtel National will use the preliminary results from this analysis to identify important scenarios, radionuclides, and exposure pathways for site-specific cost/benefit analyses.

27744 (PNL-SA—9913) **Management of ocean disposal of radioactive wastes: a basis for the control of other pollutants.** Templeton, W.L. (Pacific Northwest Lab., Richland, WA (USA)). Sep 1981. Contract AC06-76RL01830. 20p. (CONF-8110104—2). NTIS, PC A02/MF A01. Order Number DE82003856.

From 3. international ocean dumping symposium; Woods Hole, MA, USA (12 Oct 1981).

To manage, on a scientific basis, the quantities of all kinds of waste disposal to coastal waters and open oceans it is necessary to assess the environmental or assimilative capacity for these materials which will not result in an unacceptable biological impact upon the components of the ecosystem nor on man who uses its resources. One approach available is that which has been demonstrated for the management of the disposal of radioactive wastes to the oceans. Methodologies have been developed, both generic and site-specific, which allow the relationship between discharge or release rate and the radiation dose to be established. Guidelines and recommendations which govern acceptable radiation exposed to man have been developed by the International Commission on Radiological Protection (ICRP). These methodologies developed for the control of radioactive wastes can be applied directly for public health protection for non-radioactive wastes such as metals and organochlorine pesticides. ICRP recommendations on justification and optimization can be integrated into an overall management philosophy in order to quantify alternative waste disposal options.

27745 (PTB-SE—4) **Site selection and plant conception for final storage of radioactive waste in the Gorleben area.** Viehl, E. (Physikalisch-Technische Bundesanstalt, Braunschweig (Germany, F.R.); Physikalisch-Technische Bundesanstalt, Berlin (Germany, F.R.)). Mar 1981. 34p. (In German). Fachinformationszentrum Energie, Physik, Mathematik, Karlsruhe, Germany, F.R.

The salt deposit of Gorleben was provisionally designed as a site of radioactive waste storage and is at present being closely examined by the Physikalisch-Technische Bundesanstalt (Federal Authority of Physics and Engineering) as a function of an extensive site investigation program. In order to perform the long-term separation of radioactive waste from the biosphere it is not sufficient to have exact knowledge of the geological features, but a concept has to be worked out for a radioactive waste storage in the planned stratum. Besides, before storage the radioactive wastes have to be treated such as to meet the requirements in the storage. A systems analysis based on the three components mentioned before as well as on the results of continued research programs will show whether storage of radioactive wastes in the salt deposit of Gorleben can be realized.

27746 (PTB-SE—4) **Site selection and plant conception for final storage of radioactive waste in the Gorleben area.** Viehl, E. (Physikalisch-Technische Bundesanstalt, Braunschweig (Germany, F.R.); Physikalisch-Technische Bundesanstalt, Berlin (Germany, F.R.)). Mar 1981. 34p. (In German). Physikalisch-Technische Bundesanstalt, Braunschweig (Germany, F.R.).

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27747 (RFP—3091) **Literature survey of interior-surface materials for the Advanced Size Reduction Facility.** Younger, A.F.; Briggs, J.L. (Rockwell International Corp., Golden, CO (USA). Rocky Flats Plant). 3 Oct 1981. Contract AC04-76DP03533. 13p. NTIS, PC A02/MF A01. Order Number DE82004575.

A literature survey was conducted to characterize optimum interior surface coatings for an advanced size reduction facility. The size reduction facility will process decommissioned stainless steel apparatus used for the chemical recovery of plutonium. The literature surveyed included topics pertinent to the selection of suitable interior surface coatings for the proposed facility, e.g., decontaminability, chemical resistance, radiation stability, flammability, and application. The literature survey has identified generic coatings and liners that are acceptable candidate materials for use in the size reduction facility.

0530 Environmental Aspects

REFER ALSO TO CITATION(S) 27744, 27745, 27746, 28183, 28527

27748 (PNL—4100-Pt.2, pp 155) **PUREX/uranium oxide startup.** Napier, B.A.; Strenge, D.L. Feb 1982. NTIS, PC A08/MF A01.

In Annual Report for 1981 to the DOE Office of the Assistant Secretary for Environmental Protection, Safety, and Emergency Preparedness. Part 2. Ecological Sciences.

Pacific Northwest Laboratory is assisting DOE prepare an environmental impact statement analyzing the effects of resuming operation of the plutonium and uranium extraction (PUREX) and uranium oxide (UO_3) chemical processing facilities at Hanford. The Ecological Sciences Department is supporting this effort with its expertise in modeling the environmental transport and fate of radionuclides.

27749 (PNL—4100-Pt.2, pp 161) **Environmental assessment for advanced isotope separation.** Mellinger, P.J. Feb 1982. NTIS, PC A08/MF A01.

In Annual Report for 1981 to the DOE Office of the Assistant Secretary for Environmental Protection, Safety, and Emergency Preparedness. Part 2. Ecological Sciences.

The primary goal of the advanced isotope separation (AIS) program is to develop a uranium enrichment technology that will produce enriched uranium at a cost of less than $40 per separative work unit (SWU) (end of FY 1981 dollars) in the mid 1990s. There are three potential applications for an AIS process, all of which significantly lower the cost of uranium enrichment. This document compares the environmental impacts of the three alternative AIS technologies. The primary purpose of the environmental assessment is to provide the environmental impact perspective to the Process Evaluation Board (PEB) that will be responsible for recommending one of the AIS technologies for the demonstration phase of research and development.

0540 Health And Safety

REFER ALSO TO CITATION(S) 27741, 27744, 27748, 28713

27750 (PNL—4095) **Estimated airborne release of radionuclides from the Battelle Memorial Institute Columbus Laboratories JN-1b building at the West Jefferson site as a result of postulated damage from severe wind and earthquake hazard.** Mishima, J.; Ayer, J.E. (Pacific Northwest Lab., Richland, WA (USA)). Nov 1981. Contract AC06-76RL01830. 47p. NTIS, PC A03/MF A01. Order Number DE82004580.

The potential airborne releases of radionuclides (source terms) that could result from wind and earthquake dmage are estimated for the Battelle Memorial Institute Columbus Laboratories JN-1b Building at the West Jefferson site in Ohio. The estimated source terms are based on the damage to barriers containing the radionuclides, the inventory of radionuclides at risk, and the fraction of the inventory made airborne as a result of the loss of containment. In an attempt to provide a realistic range of potential source terms that include most of the normal operating conditions, a best estimate bounded by upper and lower limits is calculated by combining the upper-bound, best-estimate, and lower-bound inventories-at-risk with an airborne release factor (upper-bound, best-estimate, and lower-bound if possible) for the situation. The factors used to evaluate the fractional airborne release of materials and the exchange rates between enclosed and exterior atmospheres are discussed. The postulated damage and source terms are discussed for wind and earthquake hazard scenarios in order of their increasing severity.

27751 (PNL—4100-Pt.1, pp 101-103) **Inhalation hazards to uranium miners.** Cross, F.T. Feb 1982. NTIS, PC A10/MF A01.

In Pacific Northwest Laboratory annual report for 1981 to the DOE Office of Energy Research. Part 1. Biomedical sciences.

This project is investigating levels of uranium mine air contaminants, using both large and small experimental animals to model human respiratory system disease. Lung cancer and deaths by degenerative lung disease have reached epidemic proportions among uranium miners, but the cause-effect relationships for these diseases are based on inadequate epidemiological data. This project identifies agents or combinations of agents (both chemical and radiological) and their exposure levels that produce respiratory tract lesions, including respiratory epithelial carcinoma, pneumonconiosis and emphysema.

27752 **EPRI nuclear fuel-cycle accident risk assessment.** *Nuclear Safety;* **22**: No. 3, 300-306(May 1981).

The present results of the nuclear fuel-cycle accident risk assessment conducted by the Electric Power Research Institute show that the total risk contribution of the nuclear fuel cycle is only ~ 1% of the accident risk of the power plant; hence, with little error, the accident risk of nuclear electric power is essentially that of the power plant itself. The power-plant risk, assuming a very large usage of nuclear power by the year 2005 is only ~ 0.5% of the radiological risk of natural background. The smallness of the fuel-cycle risk relative to the power-plant risk may be attributed to the lack of internal energy to drive an accident and the small amount of dispersible material. This work aims at a realistic assessment of the process hazards, the effectiveness of confinement and mitigation systems and procedures, and the associated likelihood of errors and the estimated size of errors. The primary probabilistic estimation tool is fault-tree analysis, with the release source terms calculated using physicochemical processes. Doses and health effects are calculated with CRAC (Consequences of Reactor Accident Code). No evacuation or mitigation is considered; source terms may be conservative through the assumption of high fuel burnup (40,000 MWd/t) and short cooling period (90 to 150 d); high-efficiency particulate air filter efficiencies are derived from experiments.

0550 Regulations

REFER ALSO TO CITATION(S) 27733, 27734, 27736, 27991, 28050, 28051, 28172, 28454

27753 (LA—8901-C, pp 8p, Session 2) **Historical development and current trends in nuclear safeguards.** Oct 1981. NTIS, PC A99/MF A01.

From Advanced international training course on state systems of accounting for and control of nuclear materials; Santa Fe, NM, USA (27 Apr 1981).

This presentation briefly reviews the historical and political context of the IAEA safeguards system, its principal features, and recent developments and trends. Current political, institutional, and technical trends are discussed and their impact on nuclear safeguards systems considered. The purpose of this training session is to enable participants to: (1) outline the need and rationale for both national and international nuclear safeguards systems, and the need for coordination; (2) trace the development of international safeguards and the role of the IAEA in implementing international safeguards inspection and verification; and (3) describe the interdependence of technology, institutional arrangements (including treaties), and national policy in international cooperation and achievement of safeguards and non-proliferation goals.

27754 (LA—8901-C, pp 23p, Session 3) **IAEA guidelines for state systems of accounting and control.** Oct 1981. NTIS, PC A99/MF A01.

From Advanced international training course on state systems of accounting for and control of nuclear materials; Santa Fe, NM, USA (27 Apr 1981).

This session emphasizes guidelines for the organization and functions of the SSAC with respect to obligations arising from safeguards agreements concluded by a state with the IAEA, including the elements of the system and the performance required from it. The division among the two lectures is as follows: (a) history and development of IAEA safeguards; establishment of authority and responsibility (requirements); (B) establishment of requirements of nuclear material accounting and control; material balance areas and key measurement points; measurement systems; nuclear material flow; physical inventory taking; records and reports. The purpose of this training session is to enable participants to: (1) understand the basic objectives of safeguards and the legal basis for their application; (2) identify the three main features of a system of accounting for and control of nuclear material; (3) know who has the responsibility of establishing, implementing and maintaining an SSAC within a state of group of states party to a safeguards agreement with the IAEA; (4) describe the major requirements of nuclear materials accounting and control, (5) identify the organizational and functional elements of SSAC at the state level; (6) describe important elements and functions of nuclear material accounting and control.

27755 (LA—8901-C, pp 23p, Session 4) **IAEA safeguards operations at a bulk facility.** Oct 1981. NTIS, PC A99/MF A01.

From Advanced international training course on state systems of accounting for and control of nuclear materials; Santa Fe, NM, USA (27 Apr 1981).

This session emphasizes the basis for IAEA inspection procedures. It analyzes the performance of IAEA inspections, including independent verification measurements, examination of records, comparison with reports, and collection of necessary data for evaluation and assessment. IAEA safeguard operations at a LEU fuel fabrication plant are considered. Finally, the session addresses the preparation of reports, and current problems involved in the various activities performed by the agency inspectorate. The purpose of the session is to enable participants to: (1) understand basic objectives of IAEA operations at a bulk handling facility; (2) identify main features of inspection and evaluation activities.

27756 (LA—8901-C, pp 11p, Session 5) **National safeguards system requirements.** Oct 1981. NTIS, PC A99/MF A01.

From Advanced international training course on state systems of accounting for and control of nuclear materials; Santa Fe, NM, USA (27 Apr 1981).

This lecture will trace the history of the development of the US national safeguards program over the past 25 years. This development will include a discussion of the changing needs for the safeguards program as well as a discussion of the interrelated roles of material accounting, material control, and physical protection systems as they have been developed to meet safeguards needs. While the lecture will stress the development of the US national program, it will also include a discussion of its compatibility with international safeguards requirements as well as recent modifications that have been made in order to accommodate the implementation of IAEA safeguards in the United States. After the session, participants will be able to: (1) understand the need for a state system; (2) understand the roles of accountability, material control, physical protection; (3) understand the similarities as well as the differences between national and international safeguards programs.

27757 (LA—8901-C, pp 20p, Session 6) **National safeguards system operations at a bulk-handling facility.** Oct 1981. NTIS, PC A99/MF A01.

From Advanced international training course on state systems of accounting for and control of nuclear materials; Santa Fe, NM, USA (27 Apr 1981).

The presentation centers on the State System of Accounting and Control (SSAC) for bulk-handling facilities in the licenses sector of the US nuclear community. Details of those material control and accounting measures dealing with the national safeguards program are discussed in Session 6a. The concept and role of the Fundamental Nuclear Material Control (FNMC) Plan are discussed with the participants. In Session 6b, the lecture focusses on the international safeguards program of the US SSAC. The relationship of the national and international requirements is discussed as they relate to the IAEA INFCIRC/153 document. The purpose of this session is to enable participants to: (1) understand the basic MC and A elements in an SSAC; (2) understand which MC and A elements serve the country's national interests and those that serve IAEA safeguards.

27758 (LA—8901-C, pp 26p, Session 14) **Principles of near-real-time materials accounting and control systems.** Oct 1981. NTIS, PC A99/MF A01.

From Advanced international training course on state systems of accounting for and control of nuclear materials; Santa Fe, NM, USA (27 Apr 1981).

The general structural features of a national system of accountability and control and the interfaces with the IAEA safeguards system are considered. Techniques for carrying out the design of such systems, including modeling and simulation, are discussed. Measures of systems performance and methods for evaluating those measures are described. Examples of the safeguards design process for selected fuel-cycle facilities will be presented. The purpose of this session is to enable participants to: (1) identify the major components of an effective national system of accountability for nuclear materials; (2) describe qualitatively methods for designing an accountability system; (3) describe suitable performance measures for an effective accountability system; and (4) identify special safeguards design considerations and applications to selected fuel-cycle facilities.

27759 (LA—8901-C, pp 59p, Session 15) **Example of an in-plant near-real-time accountancy/process control system.** Oct 1981. NTIS, PC A99/MF A01.

From Advanced international training course on state systems of accounting for and control of nuclear materials; Santa Fe, NM, USA (27 Apr 1981).

This session describes an existing computerized in-plant near-real-time accounting and process monitoring system at the Allied-General Nuclear Services (AGNS) Barnwell Nuclear Fuel Plant (BNFP). Details of the system performance, objectives, hardware, plant instrumentation, and system functions are presented. Examples of actual programs for accounting and monitoring are described and system benefits will be discussed. The purpose of this session is to enable participants to: (1) identify the major computer hardware components of functional near-real-time accounting systems; (2) identify the types of process instrumentation necessary to perform near-real-time accounting; (3) describe the major nuclear material control and accounting functions of the AGNS computer system; and (4) assess the benefits to safeguards and plant operations of a computerized near-real-time accounting system.

27760 (LA—8901-C, pp 30p, Session 16) **Performance evaluation of near-real-time accounting systems.** Oct 1981. NTIS, PC A99/MF A01.

From Advanced international training course on state systems of accounting for and control of nuclear materials; Santa Fe, NM, USA (27 Apr 1981).

Examples are given illustrating the application of near-real-time accounting concepts and principles to actual nuclear facilities. Experience with prototypical systems at the AGNS reprocessing plant and the Los Alamos plutonium facility is described using examples of actual data to illustrate the performance and effectiveness of near-real-time systems. The purpose of the session is to enable participants to: (1) identify the major components of near-real-time accounting systems; (2) describe qualitatively the advantages, limitations, and performance of such systems in real nuclear facilities; (3) identify process and facility design characteristics that affect the performance of near-real-time systems; and (4) describe qualitatively the steps necessary to implement a near-real-time accounting and control system in a nuclear facility.

27761 (LA—8901-C, pp 6p, Session 20) **Model plant key measurement points.** Oct 1981. NTIS, PC A99/MF A01.

From Advanced international training course on state systems of accounting for and control of nuclear materials; Santa Fe, NM, USA (27 Apr 1981).

The key measurement points for the model low enriched fuel fabrication plant are described as well as the measurement methods. These are the measurement points and methods that are used to complete the plant's formal material balance. The purpose of the session is to enable participants to: (1) understand the basis for each key measurement; and (2) understand the importance of each measurement to the overall plant material balance. The feed to the model low enriched uranium fuel fabrication plant is UF_6 and the product is finished light water reactor fuel assemblies. The waste discards are solid and liquid wastes. The plant inventory consists of unopened UF_6 cylinders, UF_6 heels, fuel assemblies, fuel rods, fuel pellets, UO_2 powder, U_3O_8 powder, and various scrap materials. At the key measurement points the total plant material balance (flow and inventory) is measured. The two types of key measurement points-flow and inventory are described.

27762 (LA—8901-C, pp 61p, Session 21) **Basis of accountability system.** Oct 1981. NTIS, PC A99/MF A01.

From Advanced international training course on state systems of accounting for and control of nuclear materials; Santa Fe, NM, USA (27 Apr 1981).

The first part of this presentation describes in an introductory manner the accountability design approach which is used for the Model Plant in order to meet US safeguards requirements. The general requirements for the US national system are first presented.

Next, the approach taken to meet each general requirement is described. The general concepts and principles of the accountability system are introduced. The second part of this presentation describes some basic concepts and techniques used in the model plant accounting system and relates them to US safeguards requirements. The specifics and mechanics of the model plant accounting system are presented in the third part. The purpose of this session is to enable participants to: (1) understand how the accounting system is designed to meet safeguards criteria for both IAEA and State Systems; (2) understand the principles of materials accounting used to account for element and isotope in the model plant; (3) understand how the computer-based accounting system operates to meet the above objectives.

27763 (LA—8901-C, pp 22p, Session 23) **Measurement methods used at plant.** Oct 1981. NTIS, PC A99/MF A01.

From Advanced international training course on state systems of accounting for and control of nuclear materials; Santa Fe, NM, USA (27 Apr 1981).

The general description of Session 20 on measurement methods is followed by a detailed presentation of each of the accountability measurement methods in use at the model plant. These include bulk measurements (weighing, volume, and sampling), wet chemistry analytical methods, and nondestructive assay methods. The following methods are described: gravimetric uranium analysis; isotopic analysis - emission spectroscopy, gamma counting and mass spectroscopy; fluorimetric analysis of uranium; emission spectroscopy; nondestructive analyses - scintillation detectors, waste assay measurement, enrichment meter, and active rod scanner. The purpose of the session is to enable the participants to: (1) understand the principles and practical aspects of the bulk measurement methods; (2) understand the principles and practical aspects of wet chemistry analytical methods; and (3) understand the principles and practical aspects of the nondestructive assay methods. (DMC)

27764 (LA—8901-C, pp 20p, Session 24) **Process monitoring.** Oct 1981. NTIS, PC A99/MF A01.

From Advanced international training course on state systems of accounting for and control of nuclear materials; Santa Fe, NM, USA (27 Apr 1981).

Many of the measurements and observations made in a nuclear processing facility to monitor processes and product quality can also be used to monitor the location and movements of nuclear materials. In this session information is presented on how to use process monitoring data to enhance nuclear material control and accounting (MC and A). It will be seen that SNM losses can generally be detected with greater sensitivity and timeliness and point of loss localized more closely than by conventional MC and A systems if process monitoring data are applied. The purpose of this session is to enable the participants to: (1) identify process unit operations that could improve control units for monitoring SNM losses; (2) choose key measurement points and formulate a loss indicator for each control unit; and (3) describe how the sensitivities and timeliness of loss detection could be determined for each loss indicator.

27765 (LA—8901-C, pp 11p, Session 26) **Procedure for taking physical inventories.** Oct 1981. NTIS, PC A99/MF A01.

From Advanced international training course on state systems of accounting for and control of nuclear materials; Santa Fe, NM, USA (27 Apr 1981).

This session is intended to apprise one of the various aspects of procedures and routines that Exxon Nuclear uses with respect to its nuclear materials physical inventory program. The presentation describes how plant physical inventories are planned and taken. The description includes the planning and preparation for taking the inventory, the clean-out procedures for converting in-process material to measurable items, the administrative procedures for establishing independent inventory teams and for inventorying each inventory area, the verification procedures used to include previously measured tamper-safed items in the inventory, and lastly, procedures used to reconcile the inventory and calculate MUF (materials unaccounted for). The purpose of the session is to enable participants to: (1) understand the planning and pre-inventorty procedures and their importance; (2) understand the need for and the required intensity of clean-out procedures; (3) understand how inventory teams are formed, and how the inventory is conducted; (4) understand the distinction between inventory previously measured tamper-safed items and other materials not so characterized; (5) understand the reconciliation procedures; and (6) calculate a MUF given the book and inventory results.

27766 (LA—8901-C, pp 8p, Session 27) **Material control.** Oct 1981. NTIS, PC A99/MF A01.

From Advanced international training course on state systems of accounting for and control of nuclear materials; Santa Fe, NM, USA (27 Apr 1981).

Tamper-indicating seals, when applied to containers of nuclear material, serve a vital safeguards function. Because of the importance of the seal in safeguards, it is essential that their acquisition, storage, and distribution be controlled effectively. This session describes the program used to procure and control access to tamper-safing seals. It illustrates the actual physical application of paper and metal seals to process containers. The purpose of this session is to enable participants to: (1) understand how tamper-safing seals are processed and controlled to prohibit unauthorized use; and (2) understand how the two types of seals are actually applied to process items.

27767 (LA—8901-C, pp 16p, Session 28) **Measurement control program.** Oct 1981. NTIS, PC A99/MF A01.

From Advanced international training course on state systems of accounting for and control of nuclear materials; Santa Fe, NM, USA (27 Apr 1981).

A measurement control program for the model plant is described. The discussion includes the technical basis for such a program, the application of measurement control principles to each measurement, and the use of special experiments to estimate measurement error parameters for difficult-to-measure materials. The discussion also describes the statistical aspects of the program, and the documentation procedures used to record, maintain, and process the basic data. The purpose of the session is to enable participants to: (1) understand the criteria for this type of a measurement control program; (2) understand the kinds of physical standards required for the various measurement processes, e.g., weighing, analytical, NDA; (3) understand the need for and importance of a measurement control program; (4) understand the need for special experiments to provide an improved basis for the measurement of difficult-to-measure materials; (5) understand the general scope of the program's statistical aspects; and (6) understand the basis and scope of the documentation procedures.

27768 (LA—8901-C, pp 89p, Session 29) **Preparation of a fundamental nuclear material control (FNMC) plan and DIQ.** Oct 1981. NTIS, PC A99/MF A01.

From Advanced international training course on state systems of accounting for and control of nuclear materials; Santa Fe, NM, USA (27 Apr 1981).

This session describes and illustrates how an FNMC plan is prepared for the model plant. It also describes and illustrates how the DIQ is prepared, and points out the differences between the two documents. An actual example Design Information Questionnaire (DIQ) is completed for the model plant. The purpose of this session is to enable participants to: (1) understand the basis for preparing an FNMC plan for an existing plant; and (2) prepare a DIQ for a similar plant.

27769 (LA—8901-C, pp 11p, Session 30) **Description of typical NRC inspection procedures for model LEU fuel fabrication plant.** Oct 1981. NTIS, PC A99/MF A01.

From Advanced international training course on state systems of accounting for and control of nuclear materials; Santa Fe, NM, USA (27 Apr 1981).

A summary of NRC inspection procedures for a model LEU fuel fabrication plant is presented. Procedures and methods for combining inventory data, seals, measurement techniques, and statistical analysis are emphasized.

27770 (LA—8901-C, pp 14p, Session 31) **Demonstration of a mobile NDA safeguards measurement system.** Oct 1981. NTIS, PC A99/MF A01.

From Advanced international training course on state systems of accounting for and control of nuclear materials; Santa Fe, NM, USA (27 Apr 1981).

Increasing use is being made of nondestructive assay instruments for identification and measurements of nuclear materials. Important advantages of NDA are: timeliness, portability, and ease of use. Recent developments in computer systems and NDA allow for the integration of sample planning, control of NDA, and data analysis into one transportable system. This session acquaints the course participants with the use of mobile NDA safeguards measurement systems. This session considers the practical problems and the type of results that can be expected from field use of NDA instruments. An existing mobile safeguards system will be used to demonstrate some of the differences between field and laboratory conditions. The purpose of the session is to enable participants to: (1) cite the advantages and disadvantages of a mobile NDA safeguards measurement system; (2) identify principal NDA instruments most applicable for use in a mobile system; and (3) identify selected modifications to NDA instruments for field use.

27771 (LA—8901-C, pp 5p, Session 32) **Calculating uncertainties of safeguards indices (error propagation).** Oct 1981. NTIS, PC A99/MF A01.

From Advanced international training course on state systems of accounting for and control of nuclear materials; Santa Fe, NM, USA (27 Apr 1981).

Statistical methods play an important role in making references about a material unaccounted for (MUF), shipper-receiver difference, operator-inspector difference, and other safeguards indices. This session considers the sources and types of measurement errors and treats a specific example to illustrate how the variance of MUF is calculated for the model plant. The purpose of this session is to enable participants to: (1) identify the sources of measurement errors pertinent to safeguards for model plant and similar plants; (2) characterize the types of measurement errors as they affect the uncertainties of safeguards indices; (3) calculate the variance of any arbitrary function of random variables; and (4) calculate the variances of the plant MUF for plants similar to the model plant.

27772 (LA—8901-C, pp 4p, Session 33) **Calculating the variance of the difference statistic.** Oct 1981. NTIS, PC A99/MF A01.

From Advanced international training course on state systems of accounting for and control of nuclear materials; Santa Fe, NM, USA (27 Apr 1981).

In continuing the discussion of Session 20, this session centers on calculating the variances of a difference statistic. This statistic arises in shipper-receiver difference analyses, and in inspection situations. The purpose of this session is to enable participants to: (1) explain the role of statistics in making inferences based on variables inspection data; and (2) calculate the variance of a difference statistic, either a shipper-receiver difference or a facility-inspector difference.

27773 (LA—8901-C, pp 4p, Session 34) **Estimation of measurement variances.** Oct 1981. NTIS, PC A99/MF A01.

From Advanced international training course on state systems of accounting for and control of nuclear materials; Santa Fe, NM, USA (27 Apr 1981).

In the previous two sessions, it was assumed that the measurement error variances were known quantities when the variances of the safeguards indices were calculated. These known quantities are actually estimates based on historical data and on data generated by the measurement program. Session 34 discusses how measurement error parameters are estimated for different situations. The various error types are considered. The purpose of the session is to enable participants to: (1) estimate systematic error variances from standard data; (2) estimate random error variances from data as replicate measurement data; (3) perform a simple analysis of variances to characterize the measurement error structure when biases vary over time.

27774 (LA—8901-C, pp 6p, Session 35) **Statistical sample plans.** Oct 1981. NTIS, PC A99/MF A01.

From Advanced international training course on state systems of accounting for and control of nuclear materials; Santa Fe, NM, USA (27 Apr 1981).

In auditing and in inspection, one selects a number of items by some set of procedures and performs measurements which are compared with the operator's values. This session considers the problem of how to select the samples to be measured, and what kinds of measurements to make. In the inspection situation, the ultimate aim is to independently verify the operator's material balance. The effectiveness of the sample plan in achieving this objective is briefly considered. The discussion focuses on the model plant. The purpose of this session is to enable participants to: (1) understand the basis for inspection plans and procedures; (2) perform simple calculations for selecting attributes inspection sampling plans; and (3) understand how a sample plan may be evaluated for effectiveness.

27775 **Department of Energy requirements for the physical protection of special nuclear material.** Rich, B.L. (US DOE, Washington, DC). *Nuclear Materials Management;* **9**: 73-80(1980). (CONF-800655—).

From 21. annual meeting of the Institute of Nuclear Materials Management; Palm Beach, FL, USA (30 Jun 1980).

Physical protection of special nuclear material in the Department of Energy (DOE) is required and provided to achieve two major objectives. These are the protection of the health and safety of the public and the protection of the DOE's national security interests. DOE approaches the setting of requirements by characterizing the threat to special nuclear material and then developing and implementing standards and requirements which leave sufficient flexibility to account for the varied environments found in the DOE field complex. Assurance that the requirements are effective is provided through a mix of safeguards elements comprised of people, procedures, and equipment as well as through institutional oversight.

27776 **Physical protection of advanced reactors.** Darby, J.L. (Sandia Lab, Albuquerque, NM). *Nuclear Materials Management;* **9**: 81-87(1980). (CONF-800655—).

From 21. annual meeting of the Institute of Nuclear Materials Management; Palm Beach, FL, USA (30 Jun 1980).

Design aspects of liquid metal fast breeder reactors are discussed in terms of physical protection considerations, and important points generic to any future reactor design which impact physical protection are thereby indicated. Current thoughts on physical protection systems for future reactors are discussed, and two areas where future systems may differ most from current systems are covered. The two areas are: substantial barriers at either the perimeter or building exteriors to provide more intrinsic delay to forcible entry, and operations control elements for certain vital components to prevent unauthorized manipulation by authorized personnel. 2 refs.

27777 **Gamma spectrometric technique for analysis of ^{235}U and total U content of gaseous diffusion process absorbers.** Sholeen, C.M.; Brandenburg, R.W.; Roche, C.T.; Perry, R.B. (Argonne Natl Lab, Ill). *Nuclear Materials Management;* **9**: 114-126(1980). (CONF-800655—).

From 21. annual meeting of the Institute of Nuclear Materials Management; Palm Beach, FL, USA (30 Jun 1980).

Nondestructive assay (NDA) procedures have been developed to measure the /sup 235/U and total U content of scrap and waste material from a gaseous diffusion plant. The assay techniques use transmission measurements of the 110-, 130-, 177-, 198-, and 308-kev gamma rays from a /sup 169/Yb source. The NDA agrees with the wet chemical assay within the uncertainty of two separate assays for more than 90% of the samples. 5 refs.

27778 **Guidelines for preparing IAEA design information questionnaires.** Swartz, J.M.; Bieber, A.M. (Sci Appl Inc, La Jolla, Calif). *Nuclear Materials Management;* **9**: 224-229(1980). (CONF-800655—).

From 21. annual meeting of the Institute of Nuclear Materials Management; Palm Beach, FL, USA (30 Jun 1980).

The format of the IAEA Design Information Questionnaires and the SAI prepared guidelines for completing them, is described. The guidelines should assist facility operators in meeting the time constraints set forth in the Subsidiary Arrangements by effectively

supplying the information needed by the IAEA and in minimizing resource allocations to the preparation effort. 8 refs.

27779 **Implementing advanced data analysis techniques in near-real-time materials accounting.** Markin, J.T.; Baker, A.L.; Shipley, J.P. (Los Alamos Sci Lab, NM). *Nuclear Materials Management;* 9: 236-244(1980). (CONF-800655—).

From 21. annual meeting of the Institute of Nuclear Materials Management; Palm Beach, FL, USA (30 Jun 1980).

Materials accounting for special nuclear material in fuel cycle facilities is implemented more efficiently by applying decision analysis methods, based on estimation and detection theory, to analyze process data for missing material. These methods are incorporated in the computer program DECANAL. This program is a useful tool for aggregating and testing materials accounting data for timely detection of missing material. 6 refs.

27780 **Small force engagement experimentation.** Wilde, R.L. (Sandia Lab, Albuquerque, NM). *Nuclear Materials Management;* 9: 310-318(1980). (CONF-800655—).

From 21. annual meeting of the Institute of Nuclear Materials Management; Palm Beach, FL, USA (30 Jun 1980).

A simulated tactical engagement capability utilizing laser-equipped weapons and detector-equipped players is described, which can be used for guard training, security plan effectiveness evaluations and, to a limited degree, computer model validation. Included is a description of the reasons for Sandia involvement, the Multiple Integrated Laser Engagement System (MILES), the small force engagement systems approach, security system effectiveness testing, pending equipment upgrades, and conclusions reached. 7 refs.

27781 **Investigation of the source term resulting from direct explosive violation of an irradiated fuel shipping cask.** Schmidt, E.W.; Lahs, W.R. (Battelle Columbus Lab, Ohio). *Nuclear Materials Management;* 9: 328-341(1980). (CONF-800655—).

From 21. annual meeting of the Institute of Nuclear Materials Management; Palm Beach, FL, USA (30 Jun 1980).

A current U.S. Nuclear Regulatory Commission (USNRC) research program is described whose objective is to establish the consequences of postulated terrorist attacks on spent fuel shipping casks. In one project within this program, a laboratory scale experimental investigation is being conducted to determine a bounding estimate of the radiological source term resulting from a specified shaped charge attack on a spent fuel shipping cask. 2 refs.

27782 **Advanced access control system.** King, R.W.; Barnes, L.D. (Allied Gen Nucl Serv, Barnwell, SC). *Nuclear Materials Management;* 9: 362-369(1980). (CONF-800655—).

From 21. annual meeting of the Institute of Nuclear Materials Management; Palm Beach, FL, USA (30 Jun 1980).

A prototype voice verification system has been installed which provides the required positive identification at the main site access control point. This system compares an individual's file voice print with a sample voice print obtained from the individual when an attempt is made to enter the site. The voice system transmits the individual's identify to a central processor. The system installed at the Barnwell Nuclear Fuel Plant is described.

27783 **Combined SAFE/SNAP approach to safeguards evaluation.** Engi, D.; Chapman, L.D.; Grant, F.H.; Polito, J. (Sandia Lab, Albuquerque, NM). *Nuclear Materials Management;* 9: 420-426(1980). (CONF-800655—).

From 21. annual meeting of the Institute of Nuclear Materials Management; Palm Beach, FL, USA (30 Jun 1980).

The scope of a safeguards evaluation model can efficiently address one of two issues: (1) global safeguards effectiveness or (2) vulnerability analysis for individual scenarios. The Safeguards Automated Facility Evaluation (SAFE) focuses on the first issue, while the Safeguards Network Analysis Procedure (SNAP) is directed towards the second. A combined SAFE/SNAP approach to the problem of safeguards evaluation is described and illustrated through an example. 4 refs.

06 FUSION FUELS

0609 Environmental Aspects

REFER ALSO TO CITATION(S) 28716, 28742

07 ISOTOPE AND RADIATION SOURCE TECHNOLOGY

0701 Physical Isotope Separation

27784 (INIS-mf—6819, pp 651) **High temperature ion source for an on-line mass separator mode.** Afanas'ev, V.P.; Bystrov, V.A.; Lyatushinski, A.; Polyakov, A.G.; Yushkevich, Yu.V. 1981. (In Russian). Dep. NTIS (US Sales Only).

From 31. conference on nuclear spectroscopy and nuclear structure; Samarkand, USSR (14 Apr 1981).

0702 Radiation Sources

27785 (INIS-SU—25, pp 93-98) **Results of the integral experiments for iron and polyethylene spheres with californium-252 sources located in their centers.** Trykov, L.A.; Kolevatov, Yu.I.; Semenov, V.P.; Goryachev, I.V.; Volkov, V.S. 1979. (In Russian). Dep. NTIS (US Sales Only).

From 2. all-union conference on ionizing radiation protection of industrial nuclear plants; Moscow, USSR (19 Dec 1978).

The experimental data on energy distributions of neutron and gamma quanta leaking from the surfaces of polyethylene and iron spheres (with the diameters of 60 and 70 cm, respectively) containing ^{252}sub(γf sources, are presented. Information on the neutron and gamma spectra and absolute fluxes of the sources is supplied. Different methodical problems related to specificity of the spherical geometry are discussed. The calculated errors of the gamma spectra do not exceed 10-20% for Esub(γ)<5 MeV, and 30% for Esub(γ)>6 MeV. The errors of the neutron spectra do not exceed 50% for Esub(n)<20 keV, and 10-20% for Esub(n)>50 keV. The experiments with large spheres (attenuation from 10^3 to 10^4) are pointed out to be the most optimal ones.

27786 (INIS-SU—29, pp vp) **Short-time tests of surface radioactive radiation sources for thermal effect.** Kuznetsov, V.G.; Matveikov, N.I.; Cherevatenko, G.A. 1979. (In Russian). Dep. NTIS (US Sales Only).

In Radiation technology.

To evaluate damages of surface radioactive radiation sources caused by thermal effect, it is suggested that one use a mathematical model, applied to rapid tests for reliability of items of electronic engineering. Tests for model applicability were conducted using β sources with 1.5 mCi activity ^{147}Pm isotope type BSP-10. Sources were held at 400-900 deg C. Test results have shown the usability of the model for the mentioned purposes.

27787 (INIS-SU—52, pp 251-256) **Yields of characteristic x-radiation excited by 2-6 MeV alpha-particles.** Brodskij, S.M.; Mamikonyan, S.V.; Filatov, V.I. 1979. (In Russian). Dep. NTIS (US Sales Only).

In Radiation technology. Issue 17.

Results of experiments on exitation of characteristic radiation in a vacuum chamber for K and L shells are presented. Thick targets made of different materials have been irradiated by α-particles from a ^{210}Po radioisotope source with an activity of 4.15 mCi. The α-particle energy has been measured with the help of lavsan films having different thicknesses. Ionization cross sections have been determined in the impulse approximation. The experimental values of yields for K shells are less than theoretical ones which is explained by the fact that at ionization cross-section calculations an increase in the electron-binding energy caused by penetration of an α-particle into the K shell has not been taken into account.

27788 **(SAND—81-1629) Beneficial uses program. Progress report for period ending June 30, 1980.** Yeager, J.G. (ed.). (Sandia National Labs., Albuquerque, NM (USA)). Oct 1981. Contract AC04-76DP00789. 39p. NTIS, PC A03/MF A01. Order Number DE82003112.

Progress in research on beneficial uses of gamma irradiated sewage sludge is reported with a review of activities at the Sandia Irradiator for Dried Sewage Solids (SIDSS) facility; programs for promoting the transfer of the sewage sludge irradiation technology to the municipal sector which is concerned with sludge management; results of pathogen-reduction studies; studies of the effects of irradiated sewage sludge ingestion on the reproductive characteristics and weight gain of ewes; and research on the effects of sludge additions on the behavior of heavy metals in soils. (LCL)

0703 Isotopic Power Supplies

REFER ALSO TO CITATION(S) 28109

27789 **(INIS-SU—57, pp 30-41) Evaluation of specific energy capacity and some other parameters of perspective radioisotope thermoelectric generators on the base of ^{90}Sr.** Terent'ev, V.P.; Zharkov, V.A.; Pustovalov, A.A.; Zorina, T.P. 1980. (In Russian). Dep. NTIS (US Sales Only).

In Radiation techniques. Issue 19. Questions of nuclear science and techniques.

Evaluation results of specific energy capacity ν for the radioisotopic thermoelectric generator (RITEG) on the base of ^{90}Sr are presented for constructing RITEG with characteristics close to calculation ones. The evaluations are carried out within the frames of calculation diagram representing many real properties and RITEG characteristics. The investigations are carried out for range of initial heat power of 10^{-2}-10^{-4} W, admissible radiation level - 10^{-6}-10 rem²/h and for service life period of 1-100 years. RITEG is a multilayer construction of coaxially located cylinders with diameter equal to height. Heat unit with radioisotopic fuel is placed in the centre of RITEG, tungsten biologic protection borders upon it. It is shown that ν values lie within the range from 10^{-4} to 10^{5} Wxh/kg. It is concluded that optimal service life for RITEG on the base of ^{90}Sr should be not less than 10 years.

27790 **(INIS-SU—57, pp 41-60) Evaluation of specific energy capacity and some other parameters of perspective radioisotope thermoelectric generators on the base of alpha-nuclides.** Terent'ev, V.P.; Zharkov, V.A.; Pustovalov, A.A.; Zorina, T.P. 1980. (In Russian). Dep. NTIS (US Sales Only).

In Radiation techniques. Issue 19. Questions of nuclear science and techniques.

Results of evaluations of geometric, thermal and electric characteristics of radioisotopic thermoelectric generators (RITEG) on the base of alpha decay radioisotopes ^{210}Po, ^{227}Ac, ^{238}Pu, ^{241}Am, ^{242}Cm, ^{244}Cm for different service lives are presented. Specific energy capacity is evaluated on the unit of RITEG mass. Recommendations on preferable use of radioactive fuels are presented. It is shown that all the considered alpha decay nuclides can be used as RITEG fuel.

08 HYDROGEN

0801 Production

27791 **(LA-UR—81-3484) Alternate sulfate thermochemical hydrogen cycles for use with nuclear process heat.** Bowman, M.G. (Los Alamos National Lab., NM (USA)). 1981. Contract W-7405-ENG-36. 10p. (CONF-8109102—1). NTIS, PC A02/MF A01. Order Number DE82004372.

From International colloquium on use of nuclear heat for process application; Aachen, F.R. Germany (17 Sep 1981).

The chemical reactions in the bismuth sulfate-sulfuric acid and magnesium sulfate-magnesium iodide cycles are discussed. Cycles based on solid decomposition reactions are better suited for high temperature isothermal heat sources than for gas cooled reactors. The bismuth cycle might possibly be adapted to a high temperature gas cooled system since the equilibrium dessociation pressure reaches one atmosphere at approximately 1035K and additional heat is required at lower temperatures to dry the solid and effect the low temperature reactions required to close the cycle. Two methods for conducting high temperature solid decomposition operations were tested. The first system involved a rotary kiln, which was used to study the decomposition of $ZnSO_4$ (to ZnO), $La_2(SO_4)_3$ (to $La_2O_2SO_4$) and Co_3O_4 (to CoO). The results of these studies, and some runs with $Bi_2O(SO_4)_2$ (to form $Bi_2O_{2.5}(SO_4)_{0.7}$) are tabulated. Early attempts to study $Bi_2O(SO_4)_2$ decomposition in a fluidized bed system were unsuccessful since these sulfate particles would not fluidize satisfactorily. Therefore, a dual-particle fluidized bed system was constructed for use with rapid, high temperature decomposition reactions. The dual-particle fluidized bed concept was tested by studies of $ZnSO_4$ decomposition. In these experiments, a constant flow of argon carrier gas was passed through the fluidized bed and the quantity of $ZnSO_4$ varied to obtain different mol ratios of carrier gas to sulfate feed. Temperatures were measured by means of a thermocouple on the exterior of the quartz tube containing the fluidized bed. The results from two series of experiments are tabulated.

0802 Storage

REFER ALSO TO CITATION(S) 28005

27792 **(NASA-CR—3404) Development and validation of cryogenic foam insulation for LH2 subsonic transports. Final report.** Anthony, F.M.; Colt, J.Z.; Helenbrook, R.G. (Textron Bell Helicopter, Fort Worth, TX (USA)). Feb 1981. 79p. NTIS, PC A05/MF A01.

Fourteen foam insulation specimens were tested. Some were plain foam while others contained flame retardants, chopped fiberglass reinforcement and/or vapor barriers. The thermal performance of the insulation was determined by measuring the rate at which LH2 boiled from an aluminum tank insulated with the test material. The test specimens were approximately 50 mm (2 in.) thick. They were structurally scaled so that the test cycle would duplicate the maximum thermal stresses predicted for the thicker insulation of an aircraft liquid hydrogen fuel tank during a typical subsonic flight. The simulated flight cycle of approximately 10 minutes duration heated the other insulation surface to 316 K (110 F) and cooled it to 226 K (20 F) while the inner insulation surface remained at liquid hydrogen temperature of 20 K (-423 F). Two urethane foam insulations exceeded the initial life goal of 2400 simulated flight cycles and sustained 4400 cycles with only minor damage. The addition of fiberglass reinforcement of flame retardant materials to an insulation degraded thermal performance and/or the life of the foam material. Installation of vapor barriers enhanced the structural integrity of the material but did not improve thermal performance. All of the foams tested were available materials; none were developed specifically for LH2 service.

0808 Properties

27793 **(NASA-CR—164621) Ordered ground states of metallic hydrogen and deuterium.** Ashcroft, N.W. (Cornell Univ., Ithaca, NY (USA)). Jul 1981. 6p. NTIS PC A02/MF A01.

The physical attributes of some of the more physically distinct ordered states of metallic hydrogen and metallic deuterium at T 0 and nearby are discussed. The likelihood of superconductivity in both is considered with respect to the usual coupling via the density fluctuations of the ions.

09 OTHER SYNTHETIC AND NATURAL FUELS

REFER ALSO TO CITATION(S) 27813

0901 Hydrocarbon Fuels

REFER ALSO TO CITATION(S) 27805, 27818, 27827, 27829, 27832, 27833, 27834, 27835, 27836, 27837, 27838, 27839, 27840, 27841, 27842, 27843, 27845, 27846, 27847, 27895

27794 **(CONF-811108—9) Kinetics and selectivity in the Fischer-Tropsch synthesis.** Strehlow, R.A.; Douglas, E.C. (Oak Ridge National Lab., TN (USA)). 1981. Contract W-7405-ENG-26. 13p. NTIS, PC A02/MF A01. Order Number DE82003999.

From Annual meeting of the Institute of Chemical Engineers; New Orleans, LA, USA (8 Nov 1981).

The work supports the assumption that chain lengthening reactions are rapid and also shows that the hydrogenation of olefins to form paraffins can be minimized by control of the hydrogen pressure. A metallocylcobutane intermediate in the Fischer-Tropsch reaction appears to be plausible. It was found that olefins homologate on iron catalysts in competition with hydrogenation. Since the homologation reaction occurs to an enhanced extent at lower contact times, it appears to be a fast reaction compared with hydrogenation and may share common intermediates with the Fischer-Tropsch synthesis.

27795 **Charcoal: the feasible fuel for a small, automatically fed, clean burning residential stove.** Rustad, S.; Olsen, T. (Norwegian Defence Research Establishment (NDRE), Kjeller). pp 984-995 of Residential solid fuels: environmental impacts and solutions. Cooper, J.A.; Malek, D. (eds.). Beaverton, OR; Oregon Graduate Center (1982).

From 1981 international conference on residential solid fuels; Portland, OR, USA (1 Jun 1981).

Charcoal, a highly purified biomass fuel with high energy density and clean-burning characteristics may be produced very efficiently from wood scraps in an integrated pyrolysis plant/lumberyard constellation. System studies show that this fuel can be delivered to the customer for about 2 to 4 cents/kWh, depending on raw material costs. A small, residential stove burning granulated or briquetted charcoal is being developed to satisfy the modern society's demand for fully controlled and automated heating performance with a minimum of air pollution. Complete combustion with minimum excess air makes high efficiencies obtainable over wide power levels. The design makes it possible to maintain a stationary combustion zone with a constant thickness fuel layer in a continuous feeding system. Preliminary tests have indicated low levels of aldehydes and unburned hydrocarbons. Combustion efficiency and output power is computed using infrared flue gas analysis and continuous fuel weight registration.

0902 Alcohol Fuels

REFER ALSO TO CITATION(S) 27818, 27825, 27832, 27835

27796 **(LBL—13343) By-product inhibition effects on ethanolic fermentation by Saccharomyces cerevisiae.** Maiorella, B.; Blanch, H.W.; Wilke, C.R. (Lawrence Berkeley Lab., CA (USA)). Aug 1981. Contract W-7405-ENG-48. 43p. (CONF-810813—15). NTIS, PC A03/MF A01. Order Number DE82003714.

From National American Chemical Society summer meeting; New York, NY, USA (23 Aug 1981).

Inhibition by secondary fermentation products may limit the ultimate productivity of new glucose to ethanol fermentation processes. New processes are under development whereby ethanol is selectively removed from the fermenting broth to eliminate ethanol inhibition effects. These processes can concentrate minor secondary products to the point where they become toxic to the yeast. Vacuum fermentation selectively concentrates nonvolatile products in the fermentation broth. Membrane fermentation systems may concentrate large molecules which are sterically blocked from membrane transport. Extractive fermentation systems, employing nonpolar solvents may concentrate small organic acids. By-product production rates and inhibition levels in continuous fermentation with Saccharomyces cerevisiae have been determined for acetaldehyde; glycerol; formic, lactic and acetic acids; 1-propanol; 2-methyl-1-butanol; and 2,3,-butanediol; to assess the potential effects of these by-products on new fermentation processes. Mechanisms are proposed for the various inhibition effects observed.

27797 **(PB—81-153876) Legislative compendium: alcohol fuels (96th Congress).** (National Alcohol Fuels Commission, Washington, DC (USA)). 14 Apr 1980. 33p. NTIS, PC A03/MF A01.

A complete listing of all legislation introduced during the first 16 months of the 96th Congress on the subject of alcohol fuels and biomass energy. Including more than 120 bills, each entry includes: bill title, sponsor and certain co-sponsors, date of introduction, committee referred to, a listing of the major provisions, the Federal Agencies affected by the bill, and a brief history of Congressional action on the bill through April 14, 1980. All bills are cross referenced on subjects such as: financial assistance, research and development, federal use of gasohol, and tax incentives.

27798 **(PB—81-160293) Small waste to ethanol plants, Phase I.** Huff, G.F.; Fogle, M.C. (Alternate Energy Associates, Inc., Pittsburgh, PA (USA)). Sep 1980. 28p. NTIS, PC A03/MF A01.

This is a study of the economics of the conversion of waste cellulose to ethanol through enzyme hydrolysis developed at three production levels: 1 million, 5 million, and 10 million gallons per year of motor grade alcohol. The feedstock is the combustible portion of MSW and a nearby waste separation plant is assumed. It is also assumed that the alcohol plant is located inside the fence of an existing operating facility where steam and other utilities and services are available for purchase. No credit is taken for the protein by-product of the fermentation process; it is dried and used as boiler fuel or the parent plant. Study results indicate none of these plants to be competitive without a substantial subsidy. The enzyme technology is too capital intensive to be suitable for small plants.

27799 **(PB—82-117904) Review of the compatibility of methanol/gasoline blends with motor vehicle fuel systems.** Garbe, R.J. (Environmental Protection Agency, Ann Arbor, MI (USA)). May 1981. 18p. NTIS, PC A02/MF A01.

This literature review of the compatibility effects of methanol/gasoline blends on vehicle systems has been undertaken as part of a larger effort by EPA to evaluate the request for a waiver of the Section 211(f) fuel additive regulations submitted by Anafuel Unlimited on February 20, 1981. This waiver has been requested by Anafuel for Petrocoal, an oxygenated, unleaded gasoline blend containing up to 12% methanol, up to 6% C-4 alcohols (not identified) and up to 0.033 g/gal but not less than 0.023 g/gal of a proprietary compound claimed by Anafuel to be a corrosion inhibitor.

0904 Solid Waste And Wood Fuels

REFER ALSO TO CITATION(S) 27815, 27816, 27817, 27826, 27844, 27845, 27849, 28124, 28230, 28231, 28232, 28233, 28234, 28235, 28236, 28237, 28238, 28487, 28488, 28489, 28490, 28491, 28492, 28493, 28494, 28495, 28496, 28497, 28498, 28499, 28500, 28501, 28502, 28503, 28504, 28505, 28506, 28508, 28510, 28512, 28513, 28520, 28521, 28550

27800 **Residential solid fuels: environmental impacts and solutions.** Cooper, J.A.; Malek, D. (eds.). Beaverton, OR; Oregon Graduate Center (1982). 1281p. (CONF-810674—). Oregon Graduate Center, Beaverton, OR.

From 1981 international conference on residential solid fuels; Portland, OR, USA (1 Jun 1981).

The objective of this conference was to bring together the latest information on potential environmental and health problems related to emissions from the residential use of solid fuels and potential engineering and regulatory solutions. Seventy-five papers were presented at the symposium and sixty-five appear in these proceedings. Sixty of these papers have been abstracted separately for inclusion in the Energy Data Base (EDB). Five papers have been previously announced in EDB. (DMC)

27801 Chemical and biological characterization of emissions from combustion of wood and wood-chips in small furnaces and stoves. Rudling, L. (Swedish Water and Air Pollution Research Inst., Stockholm); Ahling, B.; Loefroth, G. pp 34-53 of Residential solid fuels: environmental impacts and solutions. Cooper, J.A.; Malek, D. (eds.). Beaverton, OR; Oregon Graduate Center (1982).

From 1981 international conference on residential solid fuels; Portland, OR, USA (1 Jun 1981).

The emission from the combustion of wood in a central heating furnace, wood-chips in a prechamber oven and the combustion of wood in a modified fire-place stove and an air-tight stove has been investigated using both dried and raw fuels. Flue gas analyses comprised aliphatic hydrocarbons, formaldehyde, acetaldehyde, simple aromatic hydrocarbons, chlorobenzenes, phenols, a range of polycyclic aromatic hydrocarbons and mutagenicity in the Salmonella/microsome assay in addition to the conventional indices of carbon monoxide, nitrogen oxides and particulate matter by weight. The combustion of dried wood-chips in the furnace with a prechamber oven resulted in a good combustion with relatively low emissions of carbon monoxide and organic compounds. All other cases, raw wood-chips in the prechamber oven and dried and raw wood in the furnace and the stoves, gave emissions of organic compounds in the range 10 to 1000 times higher than the combustion of dried woodchips. The use of raw wood or the combustion of dried wood at a starved condition in an air-tight stove may give rise to extremely high emissions of organic pollutants. Although the health implications of wood combustion pollutants cannot be quantified it can be calculated that it is necessary to dilute the flue gases 50 to 50,000 times in order not to exceed ambient concentrations typical for motorized urban areas (carbon monoxide, formaldehyde, ethene, benzene, benzo(a)pyrene, mutagenicity).

27802 Measurement of wood heater thermal and emissions performance. Harper, J.P.; Knight, C.V. (Tennessee Valley Authority, Chattanooga). pp 210-226 of Residential solid fuels: environmental impacts and solutions. Cooper, J.A.; Malek, D. (eds.). Beaverton, OR; Oregon Graduate Center (1982).

From 1981 international conference on residential solid fuels; Portland, OR, USA (1 Jun 1981).

The objective of this investigation was to identify those factors related to stove operation and design which may significantly affect the emissions and the efficiency of some residential wood heaters commonly used in the TVA region. The primary conclusion of the report from the environmental viewpoint, is that the thermal and emissions performances of wood heaters are inherently related. Therefore, the need exists to do both simultaneous emissions and efficiency testing. Second, fuel wood size is a major operating variable governing the efficiency and emissions of residential wood heaters. Third, a comparative basis for evaluating different wood heaters, a performance index, was proposed. This performance index equalled the ratio of the efficiency to the source severity. This performance index provides a basis for rank ordering those wood heaters which are the most highly efficient and least polluting devices. The wood heater performance index relationship also points out the importance of operating such devices at high wood burn rates.

27803 Chemistry of pyrolysis and combustion of wood. Shafizadeh, F. (Univ. of Montana, Missoula). pp 746-771 of Residential solid fuels: environmental impacts and solutions. Cooper, J.A.; Malek, D. (eds.). Beaverton, OR; Oregon Graduate Center (1982).

From 1981 international conference on residential solid fuels; Portland, OR, USA (1 Jun 1981).

Wood contains cellulose, hemicelluloses, lignin, extractives, mineral compounds and water. These components have different heat of combustion and combustion characteristics which are reflected in the combustion properties of the aggregate. The combustion process is preceded by drying and pyrolysis which provides a mixture of gaseous and volatile tarry products and a highly active carbonaceous char. The gas phase combustion of the volatile products fuels the flaming combustion; whereas the oxidation of the active char gives glowing combustion. These processes provide the energy required for the drying and pyrolysis of the substrate and propagation of the fire. When the intensity of the heat flow falls below a minimum level, oxidation of the active char could result in smoldering combustion which is accompanied by emission of unoxidized pyrolysis products. The mechanism and kinetics of the chemical reactions involved in the pyrolysis of cellulose and combustion of the products, particularly the carbonaceous char, has been discussed to show the correlation between the chemical composition and the combustion properties of the fuel.

27804 Investigation of wood pyrolysis using solid state ^{13}C nuclear magnetic resonance. Earl, W.L. (National Bureau of Standards, Washington, DC). pp 772-788 of Residential solid fuels: environmental impacts and solutions. Cooper, J.A.; Malek, D. (eds.). Beaverton, OR; Oregon Graduate Center (1982).

From 1981 international conference on residential solid fuels; Portland, OR, USA (1 Jun 1981).

The present state of the art in ^{13}C NMR of solids yields spectra with narrow lines which are useful for obtaining chemical information in intractable solids. These NMR techniques have been applied to the analysis of a series of chars obtained by subjecting spruce and oak wood to temperatures between 550 and 660°K in nitrogen. The NMR spectra obtained indicate that the cellulose starts to decompose before the lignin, but by 615°K both components are decomposing. The solid char formed is highly aromatic, probably composed of a large variety of polynuclear aromatics. Under the isothermal pyrolysis conditions employed, spruce is more resistant to decomposition than is oak.

27805 Gasification/combustion of wood. Lindstroem, O. (Royal Inst. of Tech., Stockholm, Sweden). pp 789-807 of Residential solid fuels: environmental impacts and solutions. Cooper, J.A.; Malek, D. (eds.). Beaverton, OR; Oregon Graduate Center (1982).

From 1981 international conference on residential solid fuels; Portland, OR, USA (1 Jun 1981).

Swedish authorities may not permit more than 500 ppM of carbon monoxide in the flue gas from small wood stoves and furnaces. This proposed standard requires extremely efficient combustion processes and devices. The thermochemistry of the biofuels is now subject to intense study for the development of processes for synthetic fuels. Wood is inherently a clean and highly reactive fuel and feedstock. Advanced wood combustion processes, capable of taking full advantage of the thermochemical properties of wood, may meet the proposed Swedish standard. An example of such processes is a true two-stage process with intense and rapid gasification in a primary gasification stage followed by complete combustion of the fuel gas in the secondary stage. An interesting option is to carry out the primary step as undergasification in a narrow gasification zone using as reaction gas a mixture of air and recirculated flue gas. A program has been initiated for the evaluation of this new process and related items, e.g., a second generation gasifier for combustion engines.

27806 Combustion rate of model wood volatiles. Thornton, M.M.; Malte, P.C. (Univ. of Washington, Seattle). pp 851-872 of Residential solid fuels: environmental impacts and solutions. Cooper, J.A.; Malek, D. (eds.). Beaverton, OR; Oregon Graduate Center (1982).

From 1981 international conference on residential solid fuels; Portland, OR, USA (1 Jun 1981).

The objective of our research is to measure, through the use of laboratory combustors, those conditions which promote complete combustion of wood volatiles in residential wood burning equipment. The fundamental conditions of interest are combustion temperature, residence time, stoichiometry, and air mixing intensity. The present paper deals with the combustion of prevaporized, premixed, model wood volatile compounds in a laboratory jet-stirred combustion reactor operated at 1 atm and 15 ms nominal residence time. The reactor is stabilized on a very lean mixture of H_2 and air, giving combustion temperatures in the range of 700 to 1300°C. The model compounds are added at a nominal concentration of 10,000 ppM C. The gaseous and condensable products in the combustion field are continuously sampled, and are (currently) analyzed by temperature programmed, packed column gas chromatography. Model compounds currently being studied are α-pinene, methyl ethyl ketone, and acetaldehyde. Pentane is burned as a reference

compound. Within experimental scatter, all of the compounds gave the same quantitative behavior with respect to CH_4, CO, and CO_2 concentrations. Combustion was essentially complete above 1000°C. Below 900°C, non-methane unburned organics occurred; their total concentration varied with compound type in the following order: α-pinene = pentane >> methyl ethyl ketone = acetaldehyde. At 750°C, about 5% of the α-pinene and pentane existed as unburned organics: C_2H_4 and C_3H_6 in the case of pentane, and about 20 heavier compounds in the case of α-pinene.

13 HYDRO ENERGY

REFER ALSO TO CITATION(S) 27895

1301 Resources And Availability

REFER ALSO TO CITATION(S) 27708

27807 **Long-term value of hydroelectric energy for the developing nations.** Kiely, J.R. pp 64-83 of Energy and the developing nations. Auer, P. (ed.). Elmsford, NY; Pergamon Press Incorporated (1981).

From Electric Power Research Institute workshop on energy and the developing nations; Stanford, CA, USA (19 Mar 1980).

The availability of hydroelectric power in developing countries located around the world, the cost of power plants for converting this resource to electric power, and the financing of such projects are discussed.

1303 Plant Design And Operation

27808 **(DOE/ID—12160-T1) Feasibility of using large vertical pumps as turbines for small-scale hydropower. Final technical report.** Cooper, P.; Worthen, R. (Ingersoll-Rand Research, Inc., Princeton, NJ (USA)). 1981. Contract AC07-80ID12160. 229p. NTIS, PC A11/MF A01. Order Number DE82004267.

It has long been known that a well-designed pump will also perform as a hydraulic turbine. The objective of this program was to establish the economic and technical feasibility of operating pumps as turbines in small scale hydropower plants. The economics were shown to be competitive, and turbine efficiencies of 87% were obtained in actual tests.

1305 Economics And Management

REFER ALSO TO CITATION(S) 27807, 27808

1306 Environmental Aspects

27809 (PNL—4100-Pt.2, pp 137-139) **Effects of hydroelectric generation of riverine ecology.** Becker, C.D.; Fickeisen, D.H. Feb 1982. NTIS, PC A08/MF A01.

In Annual Report for 1981 to the DOE Office of the Assistant Secretary for Environmental Protection, Safety, and Emergency Preparedness. Part 2. Ecological Sciences.

Our objective is to examine the ecological consequences of water-level manipulation that result from intensified hydroelectric power generation on aquatic resources and riparian communities. Impacts on critical species and critical life stages are emphasized. The research reported here addresses the effects of abrupt, short-term (daily and weekly) cycles in water level on fish, particularly in regard to production of valued commercial, sport, and Indian subsistent and ceremonial species. The tasks are not only designed to identify impacts of water-level fluctuations but to provide quantitative data, when possible, and to suggest means of mitigation for protecting valuable species at periods crucial to their survival.

14 SOLAR ENERGY

27810 **(TAC-SPG—81-004) Solar power generation: a bibliography with abstracts. Quarterly update, October-December 1981.** (New Mexico Univ., Albuquerque (USA). Technology Application Center). Jan 1982. 84p. Univ. of New Mexico, Albuquerque.

This annotated bibliography covers the following areas: energy overviews; solar overviews; energy conservation; environmental, health, and safety aspects; economics, law, and policy; total energy, hybrid, and combined systems repowering; solar thermal power, heliostats; thermoelectric, thermionic, thermochemical; energy storage, hydrogen; wind energy; and biomass, biofuels, and photochemical effects. (MHR)

27811 **Solar energy options for arid lands.** Meinel, A.B.; Meinel, M.P. (Univ. of Arizona, Tucson). pp 1-11 of Alternative strategies for desert development and management. Biswas, M.R.; Biswas, A.K. (eds.). Elmsford, NY; Pergamon Press (1982).

From International conference on desert development and management; Sacramento, CA, USA (31 May 1977).

Arid lands are by nature ideal locations for use of solar energy because of its availability. A variety of active and passive modes of using solar energy are reviewed. Uses vary from domestic use for heating and cooling to industrial and agricultural uses, power production and export of hydrogen. Time scales for these different uses vary considerably. Economic barriers are considered limiting factors for all solar uses other than certain passive modes.

27812 **Wind and solar energy potential for desert development.** Chatel, B.H. (United Nations, New York, NY). pp 12-29 of Alternative strategies for desert development and management. Biswas, M.R.; Biswas, A.K. (eds.). Elmsford, NY; Pergamon Press (1982).

From International conference on desert development and management; Sacramento, CA, USA (31 May 1977).

The potentials for wind utilization in underground water pumping and generation of electricity for deserts development are reviewed. Solar energy utilization is also reviewed from the point of view of water pumping (by using flat-plate collectors and concentration), as well as recent progress in solar electricity (photovoltaic and thermodynamic processes) of particular relevance to desert development.

27813 **Proceedings of the 1981 annual meeting American Section of the International Solar Energy Society, Inc. Volume 4.1. Agriculture; architecture/construction; biology/chemistry; engineering.** Glenn, B.H.; Franta, G.E. (eds.). Newark, DE; American Section of the International Solar Energy Society, Inc. (1981). 836p. (CONF-810509—(Vol.1)). American Section of the International Solar Energy Society, Inc., 205B McDowell Hall, Univ. of Delaware, Newark, DE.

From Annual conference of the International Solar Energy Society; Philadelphia, PA, USA (26 May 1981).

Sixteen papers were abstracted previously for EDB. Separate abstracts were prepared for the remaining papers. (MHR)

1401 Resources And Availability

REFER ALSO TO CITATION(S) 27661

1403 Economics

REFER ALSO TO CITATION(S) 27814

1404 Environmental, Legal, And Institutional Aspects

REFER ALSO TO CITATION(S) 27800, 27802, 27805, 28238, 28487, 28488, 28489, 28490, 28491, 28492, 28493, 28495, 28496, 28497, 28498, 28499, 28500, 28501, 28502, 28503, 28504, 28505, 28506, 28508, 28510, 28512, 28513, 28520, 28521, 28530, 28722

27814 (PNL—3718) Incentives to stimulate solar energy use: a proceedings of the second Seattle workshop. Cole, R.J.; Cone, B.W.; Sheppard, W.J.; Sommers, P.; Marcus, A.; Lenerz, D. (Pacific Northwest Lab., Richland, WA (USA)). Jun 1981. Contract AC06-76RL01830. 221p. (CONF-8009165—). NTIS, PC A10/MF A01. Order Number DE81025886.

From 2. workshop on incentives to stimulate solar energy use; Seattle, WA, USA (2 Sep 1980).

Nineteen papers are included. A separate abstract was prepared for each one. Summaries of workshop discussions on types of incentives are also included. (MHR)

27815 Residential wood combustion in Sweden environmental aspects and regulations. Carlsson, S.A. (National Swedish Environmental Protection Board, Solna). pp 1160-1165 of Residential solid fuels: environmental impacts and solutions. Cooper, J.A.; Malek, D. (eds.). Beaverton, OR; Oregon Graduate Center (1982).

From 1981 international conference on residential solid fuels; Portland, OR, USA (1 Jun 1981).

During the last four years a large extension of especially residential wood burning has been going on in Sweden. The introduction of wood-fired furnaces into dense residential areas with electric heating has become a problem. Of all organic compounds, PAH and benzene seem to be the most critical ones. According to calculations existing residential wood combustion could cause long term ambient PAH and benzene concentrations comparable with or several times worse than that found in large urban areas in Sweden. Swedish authorities are working on new performance standards for all sizes of wood combustion furnaces. Type approval emission standards for small furnaces are discussed. The National Swedish Environmental Protection Board is working on recommendations concerning wood combustion in dense residential areas.

27816 European experiences and activities in assessing the environmental impacts from wood combustion. Martin, W. (Integrated Energy Systems, Inc., Chapel Hill, NC). pp 1180-1196 of Residential solid fuels: environmental impacts and solutions. Cooper, J.A.; Malek, D. (eds.). Beaverton, OR; Oregon Graduate Center (1982).

From 1981 international conference on residential solid fuels; Portland, OR, USA (1 Jun 1981).

The paper summarizes what Western European countries have undertaken to reduce air pollution problems from wood combustion equipment. The information presented has been gathered and analyzed under an EPA contract from December 1980 to April 1981. The focus is on residential equipment design, installation, operation, and maintenance aspects which can contribute to air pollutant emissions. Included in this overview are wood fuel preparation, refining, and handling practices as they relate to clean combustion. Existing regulations and policies, as well as research activities on health impact problems are presented. The air pollution problem from wood combustion has received attention throughout the densely populated areas of Europe. One response to the problem has been the development of very sophisticated and efficient wood combustion equipment for both residential-scale and central district heating systems. Some European countries, including West Germany, Switzerland, and Scandinavian countries have implemented guidelines, standards, and inspection programs to further control the emissions from wood combustion equipment. The long history of wood use and air pollution control activities in these and other European countries could be very enlightening to the current concern over wood fuel use in the US.

27817 Residential solid fuels in the Environmental Protection Agency Region VIII states. Machlin, P.R. (Environmental Protection Agency, Denver, CO). pp 1197-1215 of Residential solid fuels: environmental impacts and solutions. Cooper, J.A.; Malek, D. (eds.). Beaverton, OR; Oregon Graduate Center (1982).

From 1981 international conference on residential solid fuels; Portland, OR, USA (1 Jun 1981).

The paper discusses residential solid fuel use as an air pollution problem in the states covered by the Region VIII Office of the Environmental Protection Agency, including Colorado, Utah, North and South Dakota, Montana, and Wyoming. The paper summarizes the control approaches in use or being considered in cities such as Vail, Colorado, and Missoula, Montana. There is substantial concern about the problem at the local level. The paper outlines possible regulatory approaches in the context of existing air quality planning programs and available technical data.

1405 Solar Energy Conversion

REFER ALSO TO CITATION(S) 27708, 27795, 27796, 27797, 27798, 27800, 27801, 27801, 27802, 27803, 27804, 27805, 27806, 27816, 28104, 28124, 28230, 28231, 28232, 28233, 28234, 28235, 28236, 28487, 28488, 28489, 28490, 28491, 28492, 28493, 28494, 28512, 28513, 28521

27818 (CONF-780447—, pp 318-325) Results of recent research on the use of pyrolysis/gasification reactions of biomass to consume solar heat and produce a usable gaseous fuel. Antal, M.J. Jr. (Princeton Univ., NJ). 1978. NTIS, PC A18/MF A01. Order Number DE82000717.

From Solar Thermal Test Facilities Users Association meeting; Golden, CO, USA (11 Apr 1978).

Biomass materials can be converted to a medium Btu gaseous fuel (300 to 600 Btu/scf) by pyrolysis/steam gasification chemical reactions. These reactions are endothermic and demand heat over temperatures ranging from 100° to 600° or 700°C. Customarily this heat is supplied by burning a part of the fuel product of the conversion process. Research at Princeton has focused on conserving the fuel product by using solar heat to drive the conversion process. When utilized in this fashion the solar heat is stored in the form of a high quality, easily transportable fuel which could be immediately marketed to consumers, or used to produce methane, methanol, ammonia, or gasoline by commercially available technologies.

27819 (DOE/ET/20405—T3) Thin films of silicon on metallurgical silicon substrates-Phase II. Topical report No. 3. Stability of thin film polycrystalline silicon solar cells. Chu, T.L. (Southern Methodist Univ., Dallas, TX (USA)). May 1978. Contract AC03-76ET20405. 9p. NTIS, PC A02/MF A01. Order Number DE81027606.

Thin film polycrystalline silicon solar cells prepared by the deposition of a silicon film containing a p-n junction on a metallurgical silicon substrate appears to be promising for terrestrial applications. The characteristics of thin film silicon solar cells have been measured in the temperature range -40°C to 100°C, and their stabilities under thermal, humidity, and optical stress have been investigated. The stability of thin film silicon solar cells appears to be comparable to that of single crystalline silicon solar cells.

27820 (DOE/ET/20405—T4) Thin films of silicon on metallurgical silicon substrates: vacuum evaporation of metallic contacts. Summary report, March 1-October 31, 1979. Chu, T.L. (Southern Methodist Univ., Dallas, TX (USA)). Jan 1980. Contract AC03-76ET20405. 4p. NTIS, PC A02/MF A01. Order Number DE81027602.

The deposition of metal films on silicon solar cells by a vacuum evaporation system utilizing electron beam heating is discussed. Tightly adherent metal films, such as silver, aluminium, titanium, etc., have been deposited reproducibly on semiconductor surfaces for electrical contacts. The design and operation of the vacuum system are described. (LEW)

27821 (DOE/ET/20410—T8) Thin films of silicon on low-cost substrates. Quarterly report No. 5, January 1-March 31, 1978. Sarma, K.R.; Gurtler, R.W.; Baghdadi, A.; Cota, M. (Motorola, Inc., Phoenix, AZ (USA)). 1978. Contract AC03-76ET20410. 42p. NTIS, PC A03/MF A01. Order Number DE81029472.

Parametric studies of silicon deposition were conducted employing the horizontal Energy Beam system. Chemical equilibrium calculations pertaining to the Energy Beam deposition conditions were performed. These calculations indicated that the reaction effi-

ciency for hydrogen reduction of silicon tetrachloride is over 95% for any chlorosilane concentration at the Energy Beam temperature of 4300°K. Because lower temperatures exist near the substrate surfaces, the kinetics of establishing the low temperature equilibrium will determine obtainable material efficiencies. From deposition experiments, the material efficiency was found to be strongly dependent on input chlorosilane concentrations. The highest material efficiency and growth rate obtained concurrently to date were 70% and 10 μm/min using the horizontal Energy Beam system. The Thermal Expansion Shear Separation (TESS) process for producing self supporting silicon films was further investigated.

27822 **(DOE/ET/20410—T9) Thin films of silicon on low-cost substrates. Quarterly report No. 6, April 1-June 30, 1978.** Sarma, K.R.; Gurtler, R.W.; Baghdadi, A.; Cota, M. (Motorola, Inc., Phoenix, AZ (USA)). 1978. Contract AC03-76ET20410. 31p. NTIS, PC A03/MF A01. Order Number DE81029305.

During this quarter optimization of Energy Beam deposition conditions to produce self-supporting polycrystalline silicon films large enough for grain enhancement by the RTR process was continued. For the first time, an Energy Beam sample was successfully grain enhanced. This sample was doped to have a resistivity of 1 to 2 Ω-cm p-type. It is now awaiting solar-cell processing. To eliminate beam arcing problems in Energy Beam deposition, a multiple (4) electrode nozzle was conceived which is being fabricated presently. Neutron activation analysis indicated that the molybdenum concentration in the silicon films produced from the molybdenum TESS substrates is 3.37 ppma in the case of the Energy Beam deposition and 6.66 ppma in the case of CVD. These concentration values are an order of magnitude higher than previous SIMS results. Solar cells have been made for the first time on grain enhanced TESS samples produced by CVD. These had a conversion efficiency of 6.7% (with V/sub OC/ = 0.53 V, J/sub Sc/ = 24 mA/cm^2 and fill factor = 53%) under AM1 illumination. Poor metallization appears to be the main reason for the low fill factor.

27823 **(DOE/ET/23003—2) Plasma-induced deposition of InP films for solar-cell applications.** Biter, W.J.; Szedon, J.R.; Takei, W.J.; Schroder, D.K. (Westinghouse Research and Development Center, Pittsburgh, PA (USA)). Oct 1981. Contract AC02-79ET23003. 52p. NTIS, PC A04/MF A01. Order Number DE82003723.

The primary aim of the program was to grow InP film onto single crystal substrates with the major approach involving the use of a plasma-induced deposition process. In its final form, the system used a metallic indium source with HCl as a carrier gas. The discharge was produced in an argon/PH_3 mixture using an inductively coupled RF power supply. The substrate was held at ground potential during the deposition. Insulating amorphous films of InP were obtained when the depositions were made on quartz substrates at room temperature. Higher substrate temperatures resulted in the deposition of polycrystalline films. Films deposited on single crystal InP were epitaxial at a substrate temperature of 340°C. The rate of deposition was found to be dependent on the substrate temperature, with 400°C being the approximate upper limit for deposition. This limit is probably due to the presence of excess chlorine in the system, which causes a temperature-dependent etching of the growing film. In addition, epitaxial film growth on InP was obtained using RF sputtering in a UHV system. An InP target was used with a PH_3/argon ambient. Temperatures above 500°C were needed to obtain epitaxial growth. Lower substrate temperatures resulted in polycrystalline film. These films were not intentionally doped but had electron concentrations of 1 x 10/sup 19/ cm/sup -3/ with mobilities of 215 cm/sup 2//V-S at 300 deg K and 8,000 cm/sup 2//V-S at 77 deg K. Variations in the supttering conditions (e.g., pressure, gas composition, etc.) did not significantly affect the carrier concentration.

27824 **(NP—2901843) Ohio waste wood for energy. Final report.** Hall, E.H.; Burch, J.E.; Amlin, J.S.; Groet, S.S.; Lawhon, W.T. Jr. (Battelle Columbus Labs., OH (USA)). 11 Jun 1981. 165p. Ohio Dept. of Energy, Publication Division, 30-E. Broad St., Columbus, OH 43215 $8.00.

The following are discussed: wood fuel potentially available in Ohio, the cost of wood fuel, a mathematical model of waste wood resources, ecological effects of whole tree utilization, and potential uses of wood fuel in Ohio. Included in appendices are: calculation of harvest residue volumes; estimation of net annual growth, annual removals, and inventory of growing stock; derivation of net growth rate tables; documentation of the data values in the OAK1 computer model; listing of OAK1 computer model; and results of the OAK1 computer model. (MHR)

27825 **(PB—81-154619) Marine plant biomass for alcohol fuels.** Cameron, F.X.; Parker, H.S.; Gates, J.M.; Klarnet, K. (Ocean Management Associates, Saunderstown, RI (USA)). Mar 1980. 195p. NTIS, PC A09/MF A01.

This report provides a basic evaluation of the potential of marine plants as an economical source of substitute fuels. The potential of different species and cultivation techniques for marine biomass production will be evaluated and compared. The analysis will consist of a review of the cultivation and harvesting technology, the production costs, and the expected biomass yield. Legal and institutional constraints as well as environmental and socio-economic impacts will also be evaluated.

27826 **(PNL—4114) Collection, transportation, and storage of biomass residues in the Pacific Northwest.** Inaba, L.K.; Eakin, D.E. (Battelle Pacific Northwest Labs., Richland, WA (USA)). Nov 1981. Contract AC06-76RL01830. 56p. NTIS, PC A04/MF A01. Order Number DE82004737.

This study was conducted to identify potential methods for the collection, transportation and storage of agricultural and forest residues in the Pacific Northwest. Information was gathered from available literature and through contacts with researchers, equipment manufacturers, and other individuals involved in forest and agricultural activities. This information was evaluated, combined, and adapted for situations existing in the Pacific Northwest. A number of methods for collection, transportation, and storage of biomass residues using currently available technology are described. Many of these methods can be applied to residue fuel materials along with their current uses in the forest and agricultural industries.

27827 (PNL-SA—10093, pp 1-26) **Gasification of forest residues to produce a methane-rich gas.** Feldmann, H.F.; Paisley, M.A.; Kim, B.C.; Appelbaum, H.R. (Battelle's Columbus Labs., OH). Oct 1981. NTIS, PC A99/MF A01.

From 13. biomass thermochemical conversion contractors meeting; Washington, DC, USA (27 Oct 1981).

A novel high-throughput gasification system is being developed for the steam gasification of wood chips. The gasification system utilizes a Battelle-developed solid-gas fluidized-bed contacting system known as a multi-solid fluid-bed (MSFB). Thus far, experiments in a nominal 200 lb (dry)/hr of 1-1/2 inch wood chips demonstrated the ability to produce a 450 to 500 Btu/SCF gas using circulating sand as a heat source for gasification. Results of a preliminary economic analysis show that (1) medium-Btu gas can be produced by this process for approximately the same price as low-Btu gas from an air-blown high throughput gasifier, (2) the process is far more economical than oxygen-blown processes, and (3) medium-Btu gas can be produced in reasonably sized (500 tpd of dry wood) plants at prices less than that of fuel oil. Current development efforts are focused on: examining the effect of wood type on gasification in an MSFB; generating scale-up data for the MSFB in cold model experiments; evaluating of the MSFB as a combustor for gasification char to provide the heat for the gasifier; and processing modeling and analysis.

27828 (PNL-SA—10093, pp 27-70) **Development of an indirectly heated biomass pyrolysis reactor.** Clements, L.D. (Texas Tech Univ., Lubbock); Cho, C.H.; Jeffrey, J.P.; Moreau, J.R.; Oliver, S.M. Oct 1981. NTIS, PC A99/MF A01.

From 13. biomass thermochemical conversion contractors meeting; Washington, DC, USA (27 Oct 1981).

The pyrolysis reactor being developed here couples indirect heating using a collection of ceramic fire tubes within the reactor, with a self powered capability. Ten to twenty percent of the pyrolysis product gas will be used to fuel the fire tubes. The studies in-

vestigate two aspects of the reactor design. One set of experiments was conducted to determine the feasibility of using infrared heating for pyrolysis. The results to date show acceptable rates of decomposition of SOLKA-FLOC AS-1040, a crystalline α-cellulose, in the temperature range 300 to 565°C. A second set of experiments were to determine the radiant heat transport properties of an absorbing fluidized bed. The experiments use matched pairs of reactors, one for flow visualization and the other for heating studies, to determine the penetration depth of infrared radiation under varying fluidization conditions. Studies with powdered alumina and with oak wood char are described. It is significant that further pyrolysis of the wood char occurred during the heating experiments.

27829 (PNL-SA—10093, pp 71-88) **Phase II: GROW project.** Findley, M.; Flanigan, V.; Sineath, H. (Univ. of Missouri, Rolla). Oct 1981. NTIS, PC A99/MF A01.

From 13. biomass thermochemical conversion contractors meeting; Washington, DC, USA (27 Oct 1981).

Phase II of the University of Missouri-Rolla GROW project, the gasification of wood using recycle gas as well as air has been studied in a large fluidized bed reactor. In general, no improvement was found in the gas produced over that of air-blown gasification. This appeared to be primarily because heat was consumed by the recycle gas and the oxygen in the air used was diluted, and both of these effects caused a higher requirement of air to maintain reactor temperature. With a very few exceptions, operation of the reactor using recycle has been adequate and safe. The effect of stripping CO_2 from the recycle gas has been about what would be expected from simply removing the diluting effect of CO_2. Hydrogen content increases and CO content decreases when recycle gas is used, and greater changes occur when potassium carbonate and wood ash catalyst are used. However, catalyst use tends to cause fusing of the bed. Improved methods of providing gasification energy are needed to fully test the potential benefits of the use of recycled product gas in wood gasification.

27830 (PNL-SA—10093, pp 89-154) **Development of biomass gasification to produce substitute fuels.** Kosowski, G.M.; Rose, G.R.; Nandi, S.P.; Singh, S.P.; Onischak, M.; Zabransky, R.F.; Babu, S.P. (Inst. of Gas Tech., Chicago, IL). Oct 1981. NTIS, PC A99/MF A01.

From 13. biomass thermochemical conversion contractors meeting; Washington, DC, USA (27 Oct 1981).

The development of a pressurized steam-oxygen fluidized-bed biomass gasification process included work on biomass characterization, handling, bench-scale devolatilization and char gasification, and the design of the process development unit (PDU). The major emphasis was on the engineering design of the PDU System.

27831 (PNL-SA—10093, pp 155-174) **Energy from biomass: the simplex process for the gasification of coal and forest pulp.** Irwin, C.F.; Schulz, R.B. (Dynecology, Inc.). Oct 1981. NTIS, PC A99/MF A01.

From 13. biomass thermochemical conversion contractors meeting; Washington, DC, USA (27 Oct 1981).

This project is the second phase of a development program designed to evaluate the technical and economic feasibility of the Sylplex process, in which shredded pulpwood is substituted for shredded refuse derived fuel in the Simplex coal and biomass gasification process. The objective is to optimize the two principal steps, pulpwood preparation and briquet production, required to manufacture sturdy, non-agglomerating Sylplex briquets. Three methods of pulping the wood chips and two methods of partially drying the chips or pulp are evaluated. A detailed cost model, derived from equipment operating cost, capital cost, and briquet formulation information, is developed to determine the least expensive process and its optimum operating conditions. This information is gathered from trial runs, vendor quotes, and lab-scale briquetting programs. The results of completed equipment trials and briquetting programs indicate that: (1) pulping raw wood chips and then partially drying the pulp is likely to be the least expensive process; (2) dry disc refining is less expensive than steam pre-treated disc refining; (3) the optimum wood particle size is produced at plate separation distances on the dry disc refiner that yield the limiting minimum energy consumption; (4) briquet strength is a weak, but statistically significant, function of pulped wood particle size, and (5) lob-lolly pine and hybrid poplar are ideally suited for energy farm production as a renewable energy source.

27832 (PNL-SA—10093, pp 175-198) **Synthesis gas from biomass: operating data on a 1 ton/da oxygen gasifier.** Reed, T.B.; Graboski, M.; Markson, M. (Solar Energy Research Inst., Golden, CO). Oct 1981. NTIS, PC A99/MF A01.

From 13. biomass thermochemical conversion contractors meeting; Washington, DC, USA (27 Oct 1981).

A 1 ton/day downdraft oxygen biomass gasifier has been built and operated on wood chips and densified biomass for 1 year. The gasifier has an extended measured bed and staged oxygen injection designed to crack all the pyrolysis tars to eliminate downstream gas cleanup requirements. The gasifier is fed continuously which allows high temperature combustion of the tars above the pyrolysis section. This in turn provides heat for the pyrolysis reaction. Actual feed rates varied up to 62 lb/hr (314 lb/ft^{2}hr) with measured oxygen/fuel ratios varying between 0.42 and 0.44. A typical gas has composition CO = 48%; CO_2 = 15%; H_2 = 32%; N_2 = 3%, and CH_4 = 2%. Organic content in the gas quench water is typically 0.02 to 0.1% of the feed. Heat losses through the insulation and grate are typically 6 to 8% of the throughput energy in the 6" diameter bed. Two liters of methanol were synthesized from the gas using the liquid phase process. The gas was found to be similar to synthesis gas from coal and presented no difficulty in synthesis.

27833 (PNL-SA—10093, pp 199-244) **Application of SGFM technology to alternate feedstocks. Phase III.** Beck, S.R.; Bartsch, R.A.; Yu, J.F.; Wang, R.C. (Texas Tech Univ., Lubbock). Oct 1981. NTIS, PC A99/MF A01.

From 13. biomass thermochemical conversion contractors meeting; Washington, DC, USA (27 Oct 1981).

The process variable study for steam-oxygen gasification of oak sawdust in the SGFM process development unit has been completed. Empirical correlations have been derived for product gas yield, H_2/CO mole ratio and carbon conversion as a function of gasifier temperature, oxygen-to-wood ratio, steam-to-wood ratio and mean solid residence time in the gasifier. These correlations indicate that a synthesis gas with a 2:1 mole ratio of H_2:CO can be produced at a temperature of 950 to 1000°C, an oxygen feed rate of 0.34 kg O_2/kg DAF wood and a steam feed rate of 0.90 kg H_2O/kg DAF wood. These results will be verified during the extended PDU runs. These runs have not been completed due to mechanical problems. All other contract objectives have been completed.

27834 (PNL-SA—10093, pp 274-296) **Steam gasification of biomass.** Coffman, J.A. (Wright-Malta Corp., Ballston Spa, NY). Oct 1981. NTIS, PC A99/MF A01.

From 13. biomass thermochemical conversion contractors meeting; Washington, DC, USA (27 Oct 1981).

The W-M Steam Gasification of Biomass project with DOE is now in its third phase. The present phase is construction and operation of a six green ton/day process development unit (PDU). Its auger kiln is 2' x 40', fitted for steam or regenerative heating, with normal operating conditions of 300 psi, 1100 to 1150°F at the exit end, and one hour dwell time. Operation during sustained runs has been nearly satisfactory in confirming bench scale chemistry and completeness of gasification, but less so on through-put. Revamping of the kiln inner structure is required to improve its heat transfer and transport characteristics. Potential applications include medium Btu gas units for industry, coupling with gas turbines for power generation, methane production, and most promising, methanol production.

27835 (PNL-SA—10093, pp 297-331) **Technical and economic assessment of liquid-fuel production from biomass.** Wan, E.I.; Price, J.D.; Simmons, J.A. (Science Applications, Inc., McLean, VA). Oct 1981. NTIS, PC A99/MF A01.

From 13. biomass thermochemical conversion contractors meeting; Washington, DC, USA (27 Oct 1981).

An ongoing engineering and economic study to assess the applicability of various advanced thermochemical processes for the production of liquid fuels from biomass is described. The technical and economic results of a comprehensive evaluation of six advanced biomass gasification processes for methanol production are summarized. The specific gasification processes evaluated include the PNL, Wright-Malta, Texas Tech, Battelle Columbus, Winkler, and SERI processes. For each gasification process selected, an inte-

grated conceptual biomass-to-methanol process was developed. A process flow sheet simulator was utilized to establish process material and energy balance data for a 500 TPD grass root methanol plant. The capital costs and the O and M costs were estimated for each plant configuration. Methanol production costs were also estimated for both private and utility financing.

27836 (PNL-SA—10093, pp 332-365) **October 1981 update on the progress in the entrained flow, fast ablative pyrolysis of biomass.** Diebold, J.; Scahill, J. (Solar Energy Research Inst., Golden, CO). Oct 1981. NTIS, PC A99/MF A01.

From 13. biomass thermochemical conversion contractors meeting; Washington, DC, USA (27 Oct 1981).

The construction of a 1-t/d conceptual demonstration reactor to fast pyrolyze biomass chips using an ablative pyrolysis technique in a cyclonic reactor has been completed. A tar vapor-cracking tube with seven thermodynamic lengths downstream of the cyclonic reactor has the capability to change the product slate from mostly tars to nearly all gases containing significant amounts of ethylene and other olefins. Char formation is deliberately suppressed with this reactor design. The design features of the reactor are described in detail. The system has undergone extensive shakedown tests which have served to familiarize the personnel with the operation and to identify minor design modifications which have improved the system's operability and flexibility. Preliminary pyrolysis results have similarities to those observed with smaller entrained flow pyrolysis reactors.

27837 (PNL-SA—10093, pp 366-398) **Fundamental pyrolysis studies' annual report for fiscal year 1981.** Milne, T.A.; Soltys, M.N. (Solar Energy Research Inst., Golden, CO). Oct 1981. NTIS, PC A99/MF A01.

From 13. biomass thermochemical conversion contractors meeting; Washington, DC, USA (27 Oct 1981).

The direct mass spectrometric studies of fast pyrolysis completed in FY81 are summarized. The latest version of the flame gas pyrolysis-molecular beam sampling system is schematized with discussion of fast data acquisition capabilities and instrument tuning. Temperature effects in the pyrolysis plume are presented. Background-corrected mass spectra are shown for the pyrolysis in ~ 900°C steam-argon of small samples (~ 10 to 20 mg) of levoglucosan, glucose, cellulose, lignin, and wood. A very preliminary identification of major products and comparison with the literature is presented. The effects of physical dimension and alkali catalysts on primary pyrolysis products is shown. A grid-heating apparatus is described and plans for FY82 outlined.

27838 (PNL-SA—10093, pp 399-444) **Effects of pressure on biomass pyrolysis and gasification.** Mok, W.S.; Antal, M.J. Jr. (Princeton Univ., NJ). Oct 1981. NTIS, PC A99/MF A01.

From 13. biomass thermochemical conversion contractors meeting; Washington, DC, USA (27 Oct 1981).

Results of research using a tubular, laminar flow, micro reactor system to explore the effects of pressure on the products of biomass pyrolysis and partial oxidation, and the heats of pyrolysis of various biomass materials are described. In general, increasing pressure increases the yields of char, CO_2 and H_2, and decreases the yields of CO, CH_4, C_2H_4, C_2H_6, and C_3H_6. The addition of small amounts of O_2 reduces the yields of all hydrocarbons, but has no effect on char formation. Increasing pressure has a dramatic effect on the heats of pyrolysis of biomass materials, changing the sign of ΔH/sub pyrolysis/ from positive (endothermic) to negative (exothermic). These results furnish important fundamental data for use by the designers of biomass gasification reactors.

27839 (PNL-SA—10093, pp 446-474) **Flash pyrolysis and hydropyrolysis of biomass.** Steinberg, M.; Fallon, P. (Brookhaven National Lab., Upton, NY). Oct 1981. NTIS, PC A99/MF A01.

From 13. biomass thermochemical conversion contractors meeting; Washington, DC, USA (27 Oct 1981).

Process chemistry data on the flash pyrolysis and hydropyrolysis of wood is being obtained in a 1" downflow entrained tubular reactor. The data indicate that at residence times of ≦ 1 second, and 900 to 1000°C and 500 psi pressure, the flash hydropyrolysis of wood yields mainly methane and water. As the residence time increases to ≧ 3 seconds, the products are methane and CO. Almost complete conversion of the carbon to methane and CO is obtained in these experiments. At lower temperatures, in the order of 800°C, 500 psi and residence times <4 seconds, significant amounts of benzene and ethane are produced. The experimental process chemistry data have been used to design and evaluate two processes in a preliminary manner. One process converts wood to high Btu pipeline gas and the other to methanol and chemical feedstocks consisting of benzene and ethylene. Reasonable plant investments which compare favorably with coal conversion plant estimates are derived.

27840 (PNL-SA—10093, pp 475-492) **Oil production via entrained flow pyrolysis of biomass.** Knight, J.A.; Gorton, C.W.; Kovac, R.J.; Elston, L.W.; Hurst, D.R. (Georgia Inst. of Tech., Atlanta). Oct 1981. NTIS, PC A99/MF A01.

From 13. biomass thermochemical conversion contractors meeting; Washington, DC, USA (27 Oct 1981).

The basis for anticipating high oil yields in entrained flow pyrolysis under appropriate operating conditions is pointed out, and documentation of demonstrated uses of wood pyrolysis oil is presented. The sound technical basis, including minimal air and water pollution, for a commercial system is discussed along with the availability of feed material. A description of the research program needed to determine the conditions for maximum oil yield in entrained flow pyrolysis of wood is given. The results of a detailed economic study for what is believed to be a realistic 40% oil yield are presented. The annual rate of return for a 250 dt/day plant is 42.3% and for a 1000 dt/day plant it is 65.3%. The corresponding pay-out periods are 1.45 and 1.04 years respectively. Thus, the production of pyrolytic oil from wood in an entrained flow system is viable from both a technical and an economical point of view.

27841 (PNL-SA—10093, pp 521-550) **Operation of the biomass liquefaction facility, Albany, Oregon.** Berry, W.L. Jr.; Thigpen, P.L. Oct 1981. NTIS, PC A99/MF A01.

From 13. biomass thermochemical conversion contractors meeting; Washington, DC, USA (27 Oct 1981).

A DOE process development unit was operated by The Rust Engineering Company in Albany, Oregon, from July 1978 until March 1981 for direct thermochemical conversion of biomass to liquid fuels. A mixture of carbon monoxide and hydrogen in the presence of sodium carbonate was reacted with wood slurries at pressures of 3000 psig and temperatures around 700°F. A product comparable to No. 6 fuel oil was produced in barrel quantities. Distillate from this crude product has characteristics similar to No. 2 fuel oil. The crude liquid product has a heating value of up to 16,000 Btu per pound, specific gravity of 1.1, viscosity of 200 cp at 210°F and oxygen content of 7%. Heating value of the distillate is 17,400 Btu per pound, viscosity 11 cp, and oxygen content 6.2%. Yields up to 53 pounds of wood-derived oil per 100 pounds of wood were obtained. The operational period culminated in Test Run No. 12 utilizing a gas fired heater and a short residence time, plug flow reactor producing 30 petroleum barrels of wood-derived oil, establishing the technical feasibility of the liquefaction process.

27842 (PNL-SA—10093, pp 576-645) **Modified extruder for feeding fine-ground cellulosic slurries to pressure systems.** White, D.H.; Homaidan, A.; Chehab, M.; Schott, N.R.; Wolf, D.; Lezzar, A. (Univ. of Arizona, Tucson). Oct 1981. NTIS, PC A99/MF A01.

From 13. biomass thermochemical conversion contractors meeting; Washington, DC, USA (27 Oct 1981).

A modified single-screw extruder has been successfully developed for pumping 50 to 60 wt % wood flour/heavy recycle wood oil slurries into 3000 to 7000 psi pressure systems. Correlations of extrusion operating data upon these slurries show that viscous dissipation and power can be minimized to meet the output pressure requirements, or higher viscous dissipation for slurry preheating at higher screw speeds can yield much higher output rates for a given extruder. Fundamental scale-up principles were applied to the experimental extrusion data for the extruder-feeder requirements of a projected 3000 barrel per day crude wood oil commercial plant. For handling the 1027 T/D of dry wood feedstock, an estimated 2.2 extruders of 16-inch diameter would be required for a 90% stream factor. The installed cost of three 16-inch diameter ex-

truder in 1981 dollars would be an estimated $2,500,000 which would provide a 50% safety factor for the first commercial plant. The on-stream horsepower of these three extruder-feeders is about 4700 Hp.

27843 (PNL-SA—10093, pp 646-656) **Examination of alternative catalysts for direct biomass liquefaction.** Rogers, D.Z.; An, T.D. (SRI International, Menlo Park, CA). Oct 1981. NTIS, PC A99/MF A01.

From 13. biomass thermochemical conversion contractors meeting; Washington, DC, USA (27 Oct 1981).

It was previously shown that water soluble salts of molybdenum are highly effective catalysts for the direct liquefaction of woodmeal in a carbon monoxide/steam process at temperatures as low as 250°C. The purpose of the work described is to determine if other transition metal salts can efficiently catalyze the direct liquefaction of biomass, and to investigate the underlying chemistry of the transition metal catalyzed direct liquefaction in a carbon monoxide/steam process. Twelve transition metal salts were tested. Of these seven (iron, manganese, chromium, ruthenium, rhenium, titanium, and vanadium) showed significant catalytic activity. Five metals (cobalt, nickel, copper, lead, and tungsten) showed little or no catalytic activity. It was found that the ligand to the metal has an important effect on catalytic activity, with cyanide or oxygen ligands being required for good catalytic activity in every metal except rhenium.

27844 (PNL-SA—10093, pp 658-668) **Development of wood as an alternative fuel for gas turbine systems.** Hamrick, J.T. (Aerospace Research Corp., Roanoke, VA). Oct 1981. NTIS, PC A99/MF A01.

From 13. biomass thermochemical conversion contractors meeting; Washington, DC, USA (27 Oct 1981).

Research was carried out by combustion of wood in a 500 horsepower gas turbine and cycle analyses were made which show that gas turbines operating in a combined cycle mode with the wood available in the US can currently supply approximately 79% of the nonhydro-nonnuclear power generated in the contiguous 48 states without disrupting industrial wood supplies for such needs as lumber and pulpwood. An example system composed of transportable modules and capable of generating 18 megawatts of power was designed. The estimated installed cost of the system was determined to be approximately $456 per kW with a delivery and installation time of twelve months. A design for the Eugene, Oregon Water and Electric Board using their existing boiler in a combined cycle mode with wood burning gas turbines resulted in an estimated retrofitting cost of $352 per kW. The output would be increased from 7.5 MW to a projected 23 MW. The economical operation of these installations will depend upon the results of the research program now underway to minimize corrosion and erosion of gas turbine buckets and stators by ash from the wood combustion products. Cyclone filters, stator and bucket surface coatings, velocity of gases relative to turbine buckets, and effects of high temperature will be evaluated on the 500 horsepower gas turbine. A major goal of the research is to eventually provide an economical wood burning gas turbine system for dispersed power generation.

27845 (PNL-SA—10093, pp 669-684) **Biomass fueled Stirling engine research and development.** Gummesson, S. (KB United Stirling AB and Co., Malmo, Sweden); Hansson, B.; Percival, W. Oct 1981. NTIS, PC A99/MF A01.

From 13. biomass thermochemical conversion contractors meeting; Washington, DC, USA (27 Oct 1981).

The work being done to investigate direct combustion of wood chips (phase 1) as well as indirect combustion by means of a gasifier, combined with a Stirling engine (phase 2) is reported. In program phase 1, two types of fuel metering systems for direct combustion have been designed, one screw feeder type (8 mm chips) and one vibrating type (16 mm chips). Metering tests with the screw feeder system have been done, indicating accurate and reliable fuel flow. Free burning tests, including emission measurements will later on be done. In program phase 2, a complete external combustion system, including biomass storage, gasifier loading system, gasifier and cyclone combustor, has been designed and built. Preliminary tests (manual control) are indicating acceptable gas quality (10 to 15% CO) and exhaust emissions, containing 20 to 400 ppM CO, and 60 to 80 ppM NO/sub x/ at an air excess of 5 to 45%. Automatic starting sequence and control system have been designed and separately tested before integration with the total system.

27846 (PNL-SA—10093, pp 685-696) **Wood gasification research for textile industry applications.** McGowan, T.F. (Georgia Inst. of Tech., Atlanta). Oct 1981. NTIS, PC A99/MF A01.

From 13. biomass thermochemical conversion contractors meeting; Washington, DC, USA (27 Oct 1981).

The textile industry consumes large quantities of natural gas for direct drying of fabrics and for boiler fuel. Low Btu gas produced from wood residues can be used as a replacement boiler fuel. The use of wood gas for boilers has limited impact on the textile drying process, however, as only 16% of drying is done with steam, with the remainder performed by direct firing of natural gas. This project was carried out to investigate the possibility of using wood gas as a direct replacement for natural gas in textile drying. The Georgia Tech updraft gasifier was used for the experimental program. During preliminary tests, the 1 million Btu/hr pilot plant produced clean burning gas which appeared viable for drying textiles. A furnace and hot gas takeoff system were designed and built. This was coupled to a modified textile drying oven and a series of tests were carried out to assess product degradation of white, colored, and chemically treated fabrics. The experimental results were very positive. The color change of samples dried with combusted wood gas was found to be in the same range as those dried with electrically heated air. In addition, little variation was found when using wood gas to dry multiple samples (under the same conditions) showing good repeatability.

27847 (PNL-SA—10093, pp 697-717) **Fundamental air-gasification engineering parameters.** Desrosiers, R. (Texas Tech. Univ., Lubbock). Oct 1981. NTIS, PC A99/MF A01.

From 13. biomass thermochemical conversion contractors meeting; Washington, DC, USA (27 Oct 1981).

A mathematical simulation of an air-blown, updraft gasifier was used to study the effect of char reactivity, particle size, and steam rate on the temperature and composition profiles in the bed of the reactor. The results are insensitive to the rate assumed for the reaction of char with oxygen since this reaction appears to be diffusion limited. For a dry air blast, the maximum temperature achieved is determined chiefly by the rate of the char-CO_2 reaction, which is a feed-dependent parameter. The rate of the char combustion reaction is inversely proportional to D/sub p/$^{1.6}$, where D/sub p/ is the particle diameter, while the char-CO_2 and char-steam reactions are inversely proportional to D/sub p/. Since the maximum temperature is strongly dependent on any parameter which affects the balance of these two sets of reactions, the particle size is a very sensitive variable. The minimum overall bed length required for complete char conversion is found to vary quadratically with D/sub p/. In the range of 1000°C, the temperature does not vary monotonically with steam rate as expected.

27848 **Wood resource and its use for energy in the United States.** High, C.J. (Dartmouth Coll., Hanover, NH). pp 670-679 of Residential solid fuels: environmental impacts and solutions. Cooper, J.A.; Malek, D. (eds.). Beaverton, OR; Oregon Graduate Center (1982).

From 1981 international conference on residential solid fuels; Portland, OR, USA (1 Jun 1981).

Wood energy use in the US has grown rapidly in the last decade to a total of approximately 2 quadrillion Btu of energy in 1980. Estimates of wood resources potentially available for energy in the US range from approximately 10 to 20 quadrillion Btu per year and estimates of potential wood energy use by the year 2000 range from 5 to 10 quadrillion Btu per year. The technologies for wood energy use in the residential, industrial and electric utility sectors are commercially available. The use of wood for manufacturing methanol is technically feasible and could soon become commercially viable.

27849 **Energy from straw and woodwaste.** Strehler, A. (Landesanstalt fuer Landtechnik, Freising, Germany). pp 729-745 of Residential solid fuels: environmental impacts and solutions. Cooper, J.A.; Malek, D. (eds.). Beaverton, OR; Oregon Graduate Center (1982).

From 1981 international conference on residential solid fuels; Portland, OR, USA (1 Jun 1981).

Since 1974 research work has been carried out in Weihenstephan on the production of energy from cereal straw and since 1978 additionally from woodwaste. First the fuel straw was characterized by determining its calorific value, taking in consideration moisture content, storage conditions, species, varieties, growth conditions and fertilization. Other characteristics of the straw - such as percentage of volatiles and chemical elements, demand for combustion air and specific fuel gas volume - were determined. Measurements were made with serial furnaces, through-burning types, under-burning types and furnaces with automatic stoking systems. Testruns were also carried out on prototype furnaces of different systems. A special under-burning furnace of low capacity for heating a domestic dwelling with automatic charging system had been developed in Weihenstephan, which is now in production by a German factory. Different types of air heaters, using high pressure bales, roto bales, big wood pieces and wood chips were constructed. Economic calculations show that straw and woodwaste are cheap fuels under certain conditions. Testruns with different types of gasifiers were done with straw and wood. Measurements were made with six different wood cutters in order to get the specific power demand. A study shows the energy demand and energy production potential of straw and woodwaste in various rural areas.

27850 **(DOE/ET/20405—T5) Thin films of silicon on metallurgical silicon substrates-Phase II. Topical report No. 2. Purification and characterization of metallurgical silicon.** Chu, T.L. (Southern Methodist Univ., Dallas, TX (USA)). [nd]. Contract AC03-76ET20405. 20p. NTIS, PC A02/MF A01. Order Number DE81027644.

Metallurgical grade silicon is a convenient starting material for the preparation of solar cell grade silicon. The purification of metallurgical silicon by the treatment of its melt with gaseous reagents, and in some cases followed by unidirectional solidification, has been investigated. The purified material was analyzed for major impurities by the atomic absorption technique. Single crystals have been prepared from purified metallurgical silicon by the Czochralski technique, and their electrical properties, such as electrical resistivity, carrier mobility, and diffusion length, were measured.

27851 **(DOE/ET/20405—T6) Thin films of silicon on metallurgical silicon substrates-Phase II. Topical report No. 1. Polycrystalline silicon P-N junctions.** Chu, T.L. (Southern Methodist Univ., Dallas, TX (USA)). [nd]. Contract AC03-76ET20405. 17p. NTIS, PC A02/MF A01. Order Number DE81027643.

Silicon films deposited on recrystallized metallurgical silicon substrates have been used for the fabrication of low cost solar cells. The substrate is polycrystalline, and the active region of the solar cell is epitaxial with respect to the substrate. Since the dark current-voltage characteristics of a solar cell are important factors affecting its conversion efficiency, the characteristics of a number of epitaxial mesa diodes of the configuration n^+-silicon/p-silicon/p^+-metallurgical silicon/graphite have been measured over a wide temperature range to study the effects of grain boundaries. The results were analyzed on the basis of the two-exponential model.

1407 Solar Thermal Power Systems

REFER ALSO TO CITATION(S) 27889

27852 (CONF-780447—, pp 344-359) **Solar energy R & D in Japan.** Noguchi, T. (Government Industrial Research Inst., Nagoya, Japan). 1978. NTIS, PC A18/MF A01. Order Number DE82000717.

From Solar Thermal Test Facilities Users Association meeting; Golden, CO, USA (11 Apr 1978).

The programs in photovoltaic conversion, solar thermal conversion, solar heating and cooling, and miscellaneous research and development concentrated on high-temperature solar furnace work, done by the Solar Energy Division of Project Sunshine in Japan are described. The designs of central receiver and hybrid solar furnace are described and illustrated. (LEW)

27853 (CONF-780447—, pp 376-398) **Computer simulation of the solar thermal test facility.** Castellano, C.C. (Dept. of Energy, Washington, DC); Best, E.N.; Coggi, J.V.; Jamieson, R.A.; Zondervan, K.L. 1978. NTIS, PC A18/MF A01. Order Number DE82000717.

From Solar Thermal Test Facilities Users Association meeting; Golden, CO, USA (11 Apr 1978).

A transient computer simulation of the Solar Thermal Test Facility (STTF) has been developed to serve as a tool to analyze a variety of experiments proposed for the STTF under differing environmental and test conditions. The STTF is a general solar test facility designed to provide solar thermal energy of up to 5 MWt. The facility consists of a relocatable heliostat field, a tower for mounting experiments, water and electrical resources, a heat rejection system, a computerized control system, and a data acquisition system. In the computer program each of these elements of the facility is modeled by an equivalent computer subroutine. The experiment module is designed with simplified, well-defined interfaces such that the program user may readily insert a new module describing his particular experiment. The experimenter may then design, plan, evaluate and verify safety of his experiment by computer prior to the test at the facility, thereby reducing test costs and improving facility utilization. A simulation of the Martin Subsystem Research Experiment (SRE) 5 MWt receiver at the STTF was performed to verify the capability of the program to simulate the performance of a complex test article and to illustrate program applications.

27854 **Control system development for an organic Rankine cycle engine.** Bergthold, F.M. Jr.; Fulton, D.G.; Haskins, H.J. (Ford Aerospace & Communications Corp., Newport Beach, CA). pp 330-336 of Solar engineering - 1981. Reid, R.L.; Murphy, L.M.; Ward, D.S. (eds.). New York, NY; American Society of Mechanical Engineers (1981).

From 3. annual systems simulation, economic analysis/solar heating and cooling operational results conference; Reno, NV, USA (27 Apr 1981).

An organic Rankine cycle engine is used as part of a solar thermal power conversion assembly (PCA). The PCA, including a direct-heated cavity receiver and a shaft-mounted alternator, is mounted at the focal point of a parabolic dish concentrator. The engine controls are required to maintain approximately constant values of turbine inlet temperature and shaft speed, despite variation in the concentrated solar power input to the receiver. The controls design approach, system models, and initial stability and performance analysis results are presented herein.

1408 Ocean Thermal Gradient And Salinity Gradient Power Systems

REFER ALSO TO CITATION(S) 27895

1409 Solar Thermal Utilization

REFER ALSO TO CITATION(S) 27818, 27889, 27889, 28111, 28119, 28119

27855 (CONF-780447—, pp 326-342) **Proposed experiment to utilize a solar facility to provide process heat for carbon gasification .** Cubicciotti, D. (SRI International, Menlo Park, CA). 1978. NTIS, PC A18/MF A01. Order Number DE82000717.

From Solar Thermal Test Facilities Users Association meeting; Golden, CO, USA (11 Apr 1978).

SRI has proposed to design an experiment for a solar tower facility concerned with metallurgical processing. Preliminary considerations of the reactions that might be conducted in such an experiment are made. Carbon gasification reactions seem to be the most likely because they are the most endothermic steps in the overall reduction of iron ore and also are of interest for production

of gaseous fuels in general. Some preliminary ideas of designs for an experiment are presented. The eventual program for designing the experiment will involve optimizing the available parameters which are: the reaction to be studied, the reaction conditions, the physical characteristics of the apparatus, the requirements of the solar tower including safety of operation.

27856 (CONF-780447—, pp 343) **Solar furnace measurements of high temperature thermodynamic properties of oxygen alloys of electropositive metals.** Sheldon, R.I.; Gilles, P.W. 1978. NTIS, PC A18/MF A01.

From Solar Thermal Test Facilities Users Association meeting; Golden, CO, USA (11 Apr 1978).

27857 (CONF-780447—, pp 360-375) **Thermal radiation testing from a user's viewpoint.** Knasel, T.M.; Sievers, R.H. Jr. 1978. NTIS, PC A18/MF A01.

From Solar Thermal Test Facilities Users Association meeting; Golden, CO, USA (11 Apr 1978).

Thermal test goals and considerations in selecting appropriate thermal sources, optics, control, and instrumentation of high thermal level tests are described. Material test procedures are discussed.

27858 (DOE/CS/31217—T8) **Solar production of industrial-process hot water. Phase III: operation and evaluation of the York Building Products Co., Inc. solar facility. Final report, September 1978-September 1981.** Bollinger, J.M.; Kaplan, N.; Wilkening, H.A. Jr. (AAI Corp., Baltimore, MD (USA)). Oct 1981. Contract AC03-76CS31217. 95p. NTIS, PC A05/MF A01. Order Number DE82003526.

AAI Corporation designed, constructed, and operated a solar heating system to provide hot water for curing concrete blocks at the York Building Products Co., Inc.'s new manufacturing facility near Harrisburg, PA. The objective of Phase III of this program was to operate, collect data, and evaluate the solar system for a three-year period. The solar facility utilizes 35 collectors with a total aperture area of 8,960 ft^2. The system is designed to deliver a water/ethylene glycol solution at 200°F to a heat exchanger, which, in turn, supplies water at 180°F to a rotoclave (underground tank) for the concrete-block curing process. A fossil-fuel boiler system also supplies the rotoclave with processed hot water to supplement the solar system. The system was operational 92.5% of the days during which the data acquisition system was functional. Sufficient solar heating was available to deliver hot water to the heat exchanger on 448 days, or 81.8% of the days on which reliable data was recorded. Total fuel saved during the three-year period was 10,284 gallons. Thus, this program has successfully demonstrated the technical feasibility of generating industrial process hot water with solar energy.

27859 (DOE/CS/31513—T1) **Passive solar heating system. Final technical report.** Mingenbach, W. (Architects Taos, NM (USA)). 28 Aug 1981. Contract FC03-77CS31513. 139p. NTIS, PC A07/MF A01. Order Number DE82003269.

The Taos State Office Building is a single-story office building in New Mexico which incorporates passive collection and storage of solar energy along with natural lighting for general illumination. The building is oriented to take advantage of early morning sunlight and is designed to supply 70% of the heating load by solar heat. The site is equipped with clerestory windows, totaling 2695 square feet, 296 square feet of south-facing windows, and east and west window scoops totaling 218 square feet. The collected solar energy is stored in 14,080 gallons of water contained in drums located in the clerestory area, as well as in the masonry construction mass. Auxiliary heat is provided via electric strips in the supply ducts. Movable, insulated shutters are provided to reduce heat loss from the clerestory window area at night. The project is described with pictures and diagrams of the final installation provided. An updated performance data report is included, and functional problems, general comments, maintenance and refurbishment recommendations are discussed. As-built wiring diagrams and operation and maintenance instructions are provided for the auxiliary heating and cooling system, and as-built diagrams and operation and maintenance instructions are given for the passive solar energy system. The acceptance testing is described and results are given. (LEW)

27860 (MASEC-R—81-086) **Summary of the Northstar Home: an extension of the solar 80 program. Topical report.** (Mid-American Solar Energy Complex, Bloomington, MN (USA)). Sep 1981. Contract AC02-79CS30150. 10p. (P—101-16). NTIS, PC A02/MF A01. Order Number DE82004688.

The objective of the Northstar program was to develop and evaluate a detailed design for a low cost house suited for cold climates which would be acceptable to mid-income families and would not need a furnace. The program's four phases are described, including a demonstration design, demonstration construction and monitoring, development of a family of alternative designs, and commrcialization. A brief description of the home is included. (LEW)

27861 (PB—81-803660) **Solar furnaces. 1970-January 1981 (citations from the Engineering Index Data Base). Report for 1970-Jan 1981.** (National Technical Information Service, Springfield, VA (USA)). Feb 1981. 73p. NTIS PC N01/MF N01.

Design, operation, and performance of solar furnaces are discussed in abstracts from worldwide literature. Topic areas include the thermodynamics and optics of operation, and the performance of the large solar furnace located at Odeillo (France). (This updated bibliography contains 68 citations, 15 of which are new entries to the previous edition.)

27862 **Partial results summary for solar domestic hot water monitoring in Pennsylvania.** Aungst, W.K. (Pennsylvania State Univ., Middletown). pp 104-111 of Solar engineering - 1981. Reid, R.L.; Murphy, L.M.; Ward, D.S. (eds.). New York, NY; American Society of Mechanical Engineers (1981).

From 3. annual systems simulation, economic analysis/solar heating and cooling operational results conference; Reno, NV, USA (27 Apr 1981).

The Pennsylvania State University acting for the Northeast Solar Energy Center (NESEC) is aiding in a monitoring program for approximately fifty solar domestic hot water systems in Pennsylvania. The monitoring program utilizes relatively low cost instrumentation, which provides information which is collected by each individual homeowner. The data are then used to estimate each systems performance. Some of the more significant results obtained to date are summarized, namely the amount of solar energy utilized by the systems to aid the heating of the domestic hot water load and a summary of the estimated dollar savings the homeowners are realizing through the use of their solar hot water systems.

27863 **Measured performance of an air thermosyphon system.** Marshall, L.S.; Burns, P.J.; Winn, C.B. (Colorado State Univ., Fort Collins). pp 122-129 of Solar engineering - 1981. Reid, R.L.; Murphy, L.M.; Ward, D.S. (eds.). New York, NY; American Society of Mechanical Engineers (1981).

From 3. annual systems simulation, economic analysis/solar heating and cooling operational results conference; Reno, NV, USA (27 Apr 1981).

The analysis and testing of an air thermosyphon system are studied. The physical system consists of a double glazed collector, ducting, backdraft dampers to prevent reverse circulation of the air, and a rock box in the north wall for thermal storage. A simulation scheme has been developed to conduct a preliminary system evaluation. A test cell has been constructed in order to obtain actual data. Temperature measurements and flow visualization in the air ducts are studied. The thermal performance of the system is evaluated by using measured data as input for the simulation model.

27864 **Sequential filter used for parameter estimation in a passive solar system.** Winn, C.B.; Pryor, D.V. (Colorado State Univ., Fort Collins). pp 130-134 of Solar engineering - 1981. Reid, R.L.; Murphy, L.M.; Ward, D.S. (eds.). New York, NY; American Society of Mechanical Engineers (1981).

From 3. annual systems simulation, economic analysis/solar heating and cooling operational results conference; Reno, NV, USA (27 Apr 1981).

The use of a sequential least squares filter for estimating passive solar system parameters is presented as it applies to certain types of systems. The method given is used to identify a particular existing system, and the results are given. A discussion is also included on a comparison of various sampling rates used by the filter, with a view toward selecting a reasonable sampling rate.

27865 **Evaluation of reliability of operational solar-energy systems.** Mavec, J. (Argonne National Lab., IL); Waite, E.; Wolosewicz, R. pp 145-150 of Solar engineering - 1981. Reid, R.L.; Murphy, L.M.; Ward, D.S. (eds.). New York, NY; American Society of Mechanical Engineers (1981).

From 3. annual systems simulation, economic analysis/solar heating and cooling operational results conference; Reno, NV, USA (27 Apr 1981).

A reliability study is presented of two solar-energy systems using air as the heat transfer medium. Failure modes and effects analysis is used to examine the controls of the systems for three operating modes. Principal components are identified for each mode, and a fault tree and reliability block diagram are constructed to structure the fault or failed sequence. Established failure rates are assigned to each component, and an exponential failure distribution is assumed. For components operating on demand at a given average frequency, the adjusted demand and normal operating failure rates are combined to reflect the total contribution. Representative operational times and component frequencies are found for each operating mode. A fault-free computer code is used to determine minimal outsets to the top event, remove redundant events, and perform necessary calculations. The computer code obtains results at each level (component, outset, and tree) using repairable and nonrepairable models.

27866 **Thermal modeling of multi-room structures.** Emery, A.F.; Kippenhan, C.J.; Heerwagen, D.R. (Univ. of Washington, Seattle). pp 151-158 of Solar engineering - 1981. Reid, R.L.; Murphy, L.M.; Ward, D.S. (eds.). New York, NY; American Society of Mechanical Engineers (1981).

From 3. annual systems simulation, economic analysis/solar heating and cooling operational results conference; Reno, NV, USA (27 Apr 1981).

A series of numerical simulations, based upon the nodal network program UWENSOL, was made to predict the hourly thermal response of a typical Pacific Northwest residence and its daily and annual energy requirements. The calculations showed that the response of the house is dependent upon its configuration, the weather and the manner in which the heating or cooling is done. In general, during winter time in the Pacific Northwest it is possible to adequately simulate the house as a collection of thermally independent zones. This eliminates the need to consider the house as a single structure composed of thermally interacting zones and permits the efficient simulation of houses which are architecturally complicated. However, during very hot summer periods, when natural ventiliation is used for cooling and the different zones have different average temperatures, there is too much energy conducted through the walls to allow the independent zone simulation to be used and the structure must be treated as an entity.

27867 **Investigation of horizontal storage tanks for solar hot water systems.** Young, M.F. (Univ. of California, Irvine); Baughn, J.W. pp 159-167 of Solar engineering - 1981. Reid, R.L.; Murphy, L.M.; Ward, D.S. (eds.). New York, NY; American Society of Mechanical Engineers (1981).

From 3. annual systems simulation, economic analysis/solar heating and cooling operational results conference; Reno, NV, USA (27 Apr 1981).

The thermal behavior of a horizontal storage tank for possible use in a solar domestic hot water system has been investigated analytically and experimentally. The purpose of the present work is to compare a simple analytical model to the measured temperature stratification in this horizontal tank. The experimental results demonstrated that axial temperature gradients were negligible compared to vertical temperature gradients. Severe mixing of the tank occurred when loads were removed unless a diffuser manifold was placed on the make-up water inlet. The analytical model used was one-dimensional (verticle) with some degree of mixing at the inlet and outlet boundaries. The temperatures at the top of the tank were predicted fairly well, but the temperatures at the bottom deviated somewhat from the predictions. It appears that some additional interior mixing not included in the present model occurs.

27868 **Comparison of some results of program show with other solar hot water computer programs.** Young, M.F. (Univ. of California, Irvine); Baughn, J.W. pp 168-174 of Solar engineering - 1981. Reid, R.L.; Murphy, L.M.; Ward, D.S. (eds.). New York, NY; American Society of Mechanical Engineers (1981).

From 3. annual systems simulation, economic analysis/solar heating and cooling operational results conference; Reno, NV, USA (27 Apr 1981).

A computer program entitled SHOW (Solar Hot Water) is capable of simulating both one and two tank designs of thermosiphon and pumped solar domestic hot water systems. SHOW differs in a number of ways from other programs, the most notable of which is the emphasis on a thermal/hydraulic model of the stratified storage tank. The present work compares the predicted performances for a typical two tank pumped system, computed by Program SHOW, with results computed using F-CHART and TRNSYS. The results show fair to good agreement between the various computer programs when comparing the annual percent solar contributions. SHOW is also used to compute the expected performance of a two tank thermosiphon system and to compare its performance to the two tank pumped system.

27869 **Regional comparison of solar, heat pump, and solar-heat pump systems.** Manton, B.E.; Mitchell, J.W. pp 196-203 of Solar engineering - 1981. Reid, R.L.; Murphy, L.M.; Ward, D.S. (eds.). New York, NY; American Society of Mechanical Engineers (1981).

From 3. annual systems simulation, economic analysis/solar heating and cooling operational results conference; Reno, NV, USA (27 Apr 1981).

A comparative study of the thermal and economic performance of the parallel and series solar-heat pump systems, stand-alone solar and stand-alone heat pump systems for residential space and domestic hot water heating has been undertaken for the United States using F-CHART 4.0. The results are useful for a regional assessment of the viability of the different systems, and for assessing policies that will encourage the implementation of the most energy efficient system.

27870 **Transient simulation of absorption machines.** Anand, D.K.; Allen, R.W.; Kumar, B. (Univ. of Maryland, College Park). pp 239-247 of Solar engineering - 1981. Reid, R.L.; Murphy, L.M.; Ward, D.S. (eds.). New York, NY; American Society of Mechanical Engineers (1981).

From 3. annual systems simulation, economic analysis/solar heating and cooling operational results conference; Reno, NV, USA (27 Apr 1981).

A model is presented for a water-cooled Lithium-Bromide/water absorption chiller and predicts its transient response both during the start-up phase and during the shut-off period. The simulation model incorporates such influencing factors as the thermodynamic properties of the working fluid, the absorbent, the heat-transfer configuration of different components of the chiller and related physical data. The time constants of different components are controlled by a set of key parameters that have been identified in this study. The results show a variable but at times significant amount of time delay before the chiller capacity gets close to its steady-state value. The model is intended to provide an insight into the mechanism of build-up to steady-state performance. By recognizing the significant factors contributing to transient degradation, steps can be taken to reduce such degradation. The evaluation of the residual capacity in the shut-off period will yield more realistic estimates of chiller COP for a chiller satisfying dynamic space cooling load.

27871 **Optimum operating conditions of absorption refrigeration systems for flat plate collector temperatures.** Kochhar, G.S.; Satcunanathan, S. (Univ. of the West Indies, St. Augustine, Trinidad). pp 260-267 of Solar engineering - 1981. Reid, R.L.; Murphy, L.M.; Ward, D.S. (eds.). New York, NY; American Society of Mechanical Engineers (1981).

From 3. annual systems simulation, economic analysis/solar heating and cooling operational results conference; Reno, NV, USA (27 Apr 1981).

An evaluation of the performance of absorption refrigeration cycles is presented with a view to determining optimum conditions for use with flat plate solar collectors. Equations for the thermodynamic performance analysis of the NH_3 - H_2O systems are formulated and solved for various combinations of temperatures of the heat interacting components of the system using available equilibrium thermodynamic property equations. Equilibrium thermodynamic property equations for the H_2O - LiBr pair are developed and used to extend the performance analysis to the H_2O - LiBr absorption cycle. It is shown that the COP increases sharply initially with generator temperature, reaches a peak value and levels off thereafter. COP also increases with lowering of condensing/absorption temperatures, the increases being significant for generation temperatures below about 80°C, which is well within the effective operational range of flat plate solar collectors. Results are also presented for the overall COP's of systems driven off flat plate collectors which show that the overall COP reaches an optimum value for a particular generator temperature.

27872 **Assessment of air solar system performance with alternate methods of analysis.** Taylor, S.L. (Automation Industries, Inc., Silver Spring, MD). pp 277-289 of Solar engineering - 1981. Reid, R.L.; Murphy, L.M.; Ward, D.S. (eds.). New York, NY; American Society of Mechanical Engineers (1981).

From 3. annual systems simulation, economic analysis/solar heating and cooling operational results conference; Reno, NV, USA (27 Apr 1981).

As an alternative to using detailed measurements to determine the energy losses of an active air solar system, the solar space heating contribution of solar systems may be evaluated using the building as the control volume for the analysis. The method can also assess solar performance using a minimum of instrumentation. A second method, used by some designers, for active solar systems performance is presented which uses modified degree day design. It uses only the active space heating system as the control volume for the analysis. Discrepancies in the results suggest that space heating designers consider all heating energy flows into the building and not just the active space heating system.

27873 **Comparison of DOE-2 and TRNSYS solar heating system simulation.** Eden, A.; Morgan, M. (Solar Energy Research Inst., Golden, CO). pp 309-318 of Solar engineering - 1981. Reid, R.L.; Murphy, L.M.; Ward, D.S. (eds.). New York, NY; American Society of Mechanical Engineers (1981).

From 3. annual systems simulation, economic analysis/solar heating and cooling operational results conference; Reno, NV, USA (27 Apr 1981).

This paper analyzes and compares the output of the solar energy sectin of DOE-2 called Component Based Simulator (CBS) and TRNSYS. Researchers from the Solar Energy Research Institute (SERI) investigated the adequacy and sensitivity of CBS when various active solar energy collectors and systems were interfaced with a standard space heating system. The analysis included both single- and double-glazed collectors with selectively and nonselectively coated absorbing surfaces, located in four different environments. The results of the study show remarkable agreement between the two programs. Minor differences in annual average collector efficiency and annual average part solar are illustrated as are the thermal load and insolation. In addition, difficulties encountered when performing this study modeling the collector systems are discussed and recommendations offered to facilitate the solar simulation process for future CBS users.

27874 **Hourly use profiles for solar domestic hot water heaters in the national solar data network.** Barvir, E.J.; Doak, L.G.; Waterman, R.E.; Gervasio, C. (Vitro Labs., Silver Spring, MD). pp 319-324 of Solar engineering - 1981. Reid, R.L.; Murphy, L.M.; Ward, D.S. (eds.). New York, NY; American Society of Mechanical Engineers (1981).

From 3. annual systems simulation, economic analysis/solar heating and cooling operational results conference; Reno, NV, USA (27 Apr 1981).

Daily hot water rates of consumption and the Hourly Profiles of Daily Hot Water Consumption for single and multiple family dwellings are provided. These new statistics obtained from the National Solar Data Network (NSDN) are significantly different from the statistics currently being used in TRNSYS, SOLCOST and F-Chart. The NSDN statistics suggest that both the daily demand and hourly use profiles used in performance models should be revised.

27875 **Implementation of an ambient temperature observer-predictor (ATOP).** Weaver, N.L. (Regional Systems Services Group, Inc., Englewood, CO); Duff, W.S. pp 325-329 of Solar engineering - 1981. Reid, R.L.; Murphy, L.M.; Ward, D.S. (eds.). New York, NY; American Society of Mechanical Engineers (1981).

From 3. annual systems simulation, economic analysis/solar heating and cooling operational results conference; Reno, NV, USA (27 Apr 1981).

An ATOP type control algorithm was developed and implemented on a programmable controller to set the rate of charge for a commercial off-peak electric furnace installed in CSU Solar House I. During a 15 day trial ATOP tracked ambient temperature to within 3.0°C rms and predicted following day average temperature to within 3.8°C rms. The ATOP based off-peak controller held peak demand to 9.5 kilowatts during the test period. For the same conditions the factory stock control hardware for the commercial off-peak furnace would have generated a peak demand of 18.8 kilowatts. However, the superior performance of the ATOP-based controller is due principally to the fact that it accounts for available energy in solar storage and in the off-peak furnace itself (which the factory control hardware does not). In a thirty day simulation, the ATOP algorithm performance was matched by a simpler single point estimation scheme exercised on the same measured temperature data. Longer term testing will be required to determine whether ATOP algorithms can improve in general on simpler temperature prediction schemes for application in load anticipating off-peak controllers.

27876 **Analysis, simulation and diagnosis of solar energy.** Waterman, R.E. (Vitro Labs., Silver Springs, MD). pp 337-344 of Solar engineering - 1981. Reid, R.L.; Murphy, L.M.; Ward, D.S. (eds.). New York, NY; American Society of Mechanical Engineers (1981).

From 3. annual systems simulation, economic analysis/solar heating and cooling operational results conference; Reno, NV, USA (27 Apr 1981).

This paper examines control system anomalies and attempts to quantify the resultant system performance characteristics and economic consequences. The study methods employed to investigate and diagnose controller malfunctions involve a blend of mathematical modelling and analysis of long term data from three solar homes in the National Solar Data Network. The diagnostic methods and results of this study should be of immediate practical value ro designers, installers and owners concerned with obtaining maximum performance from their solar energy systems.

27877 **Simplified methodology for choosing controller setpoints.** Alcone, J.M.; Herman, R.W. (Science Applications, Inc., Albuquerque, NM). pp 345-347 of Solar engineering - 1981. Reid, R.L.; Murphy, L.M.; Ward, D.S. (eds.). New York, NY; American Society of Mechanical Engineers (1981).

From 3. annual systems simulation, economic analysis/solar heating and cooling operational results conference; Reno, NV, USA (27 Apr 1981).

The selection of controller delta T set-points for solar energy systems must be made carefully to assure that unnecessary

cycling of pump or fan motors does not occur, and that a maximum amount of the available solar energy is collected. The analysis addresses how set-points can be chosen based on the efficiency curve for the collector.

27878 **TRNSYS microprocessor controller.** Piessens, L.P.; Bechman, W.A.; Mitchell, J.W. (Univ. of Wisconsin, Madison). pp 348-357 of Solar engineering - 1981. Reid, R.L.; Murphy, L.M.; Ward, D.S. (eds.). New York, NY; American Society of Mechanical Engineers (1981).

From 3. annual systems simulation, economic analysis/solar heating and cooling operational results conference; Reno, NV, USA (27 Apr 1981).

A control component for use with the TRNSYS simulation program has been developed that simulates the operation of a microprocessor controller. The component uses a truth table in combination with comparisons between input signals to generate appropriate output control signals. Although temperatures are normal input signals, other inputs such as flow rate, solar radiation, etc., can also be used. Together with other standard TRNSYS components, proportional control, night setbacks, and time delays can be simulated. Examples are given of normal operation, and of situtaions in which instabilities occur. The use of the truth table for error detection is illustrated. Some general rules for selecting timestep and error bounds are formulated. An economic comparison is made between on/off and optimal control strategy to illustrate the use of the model.

27879 **Experimental validation of dynamic control models.** Herczfeld, P.R. (Drexel Univ., Philadelphia, PA); Fischl, R.; Vardakas, G.; Wolfson, R.L.T. pp 358-366 of Solar engineering - 1981. Reid, R.L.; Murphy, L.M.; Ward, D.S. (eds.). New York, NY; American Society of Mechanical Engineers (1981).

From 3. annual systems simulation, economic analysis/solar heating and cooling operational results conference; Reno, NV, USA (27 Apr 1981).

One of the problems encountered in the control of solar heating and cooling systems is pump cycling. The purpose of this paper is to present results of an experimental study designed to validate the dynamic distributed parameter model used in investigating this problem and the more general problem of liquid flow control in solar collector loops. The validation experiments were performed at the Middlebury College facility. It consisted of first measuring the thermal time constants and transit times of the solar collector loop components. These time constants together with other system parameters and measured climatic data were used to predict the controller performance via the computer simulation model developed by the authors. The results of this simulation were compared to those obtained experimentally. The three experiments analyzed showed that the computer simulation was able to predict the controller performance well within the accuracy of the measured data.

27880 **Computer simulation for evaluating control strategies.** Sokolowski, S.J. (US Army, Fort Monmouth, NJ); Fisher, M.J.; Herczfeld, P.R.; Fischl, R.; Wolfson, R. pp 367-376 of Solar engineering - 1981. Reid, R.L.; Murphy, L.M.; Ward, D.S. (eds.). New York, NY; American Society of Mechanical Engineers (1981).

From 3. annual systems simulation, economic analysis/solar heating and cooling operational results conference; Reno, NV, USA (27 Apr 1981).

The main objective of this paper is to present a computer simulation code which accurately simulates the operation of solar energy systems under different control strategies such as either the on/off controller or the proportional flow controller. The salient feature of this simulation code is its accuracy since it continually updates a set of samples of the solution of the partial differential equation which represents the dynamic behavior of the solar system components. This approach avoids the simulation errors introduced by such methods as the finite differencing scheme which seem to influence the simulation results. The accuracy of the computer simulation has been tested against both analytic expressions for the solar energy system performance and against experimental data. As an example of the utility of this simulation code, a comparison between the performance of on/off and proportional flow controls for different pump functions is given.

27881 **Dynamic mathematical model for predicting the thermal performance of a greenhouse with thermal storage.** Arinze, E.A.; Besant, R.W.; Schoenau, G.J. (Univ. of Saskatchewan, Saskatoon). *Proceedings of the Annual Meeting - American Section of the International Solar Energy Society;* **4.1**: 3-7(1981). (CONF-810509—(Vol.1)). Philadelphia, PA, USA (26 May 1981).

A mathematical model for predicting temperatures and moisture level in a quonset type energy conserving tomato growing greenhouse is presented. The greenhouse has added thermal mass in the form of water located under the plant benches. Passive and active forms of water storage are investigated. Comparisons of the measured variables with model predictions show a high degree of correlation.

27882 **Modified degree-day procedure for estimating greenhouse heating energy requirements.** Milburn, W.F. (Duke Univ., Durham, NC). *Proceedings of the Annual Meeting - American Section of the International Solar Energy Society;* **4.2**: 8-12(1981). (CONF-810509—(Vol.1)). Philadelphia, PA, USA (26 May 1981).

This procedure is based on the use of degree-day type calculations modified by a monthly radiation balance in the greenhouse. The unique features of a greenhouse which make the calculation of its heating loads different from a residential or commercial building are the large fluxes of shortwave and longwave radiation within the structure and the presence of a substantial evapotranspiration factor due to the plants. Net radiation in the greenhouse is based on monthly average solar insolation and day temperatures and is totaled for each month. A handheld calculator is sufficient for these calculations. The procedure is applicable to free standing as well as attached type greenhouses and can account for many energy conservation techniques such as double glazing and thermal blankets. A complete sample calculation is included for a location in Pennsylvania.

27883 **Design curves for a subfloor heated solar greenhouse system.** Puri, V.M. (Solar Energy Research Inst., Golden, CO). *Proceedings of the Annual Meeting - American Section of the International Solar Energy Society;* **4.1**: 13-17(1981).

Design curves suitable for floor heated greenhouse systems have been developed under steady state conditions. The design variables considered in generating these nomograms include: pipe diameter and spacing, pipe eccentricity, floor depth, heat transport fluid flow rate, and plant canopy density. The design curves are obtained for a wide range of parameter values. The nomograms are expressed in terms of the greenhouse heat gain per unit floor area as a function of plant canopy density, and other variables as parameters. The range of fluid flow rate considered, i.e., Reynolds number, is not a significant parameter. The remainder of the variables significantly affect the greenhouse heat gain characteristics. The application of design curves, for the long-term predicted performance of the floor heating system is illustrated through an example.

27884 **Low cost solar energy heating system using aquifer energy storage for greenhouses.** Schaetzle, W.J.; Bhattarai, R.N. (Univ. of Alabama, University). *Proceedings of the Annual Meeting - American Section of the International Solar Energy Society;* **4.1**: 18-21(1981). (CONF-810509—(Vol.1)). Philadelphia, PA, USA (26 May 1981).

A low cost, solar-heating system for greenhouses has been investigated. A shallow pond collector using 4 x 4 lumber and polyethylene sheets is used for energy collection. The collectors can easily be constructed with material costs remaining under $0.25/ft^2. An aquifer is used for a large annual thermal energy storage system. The energy is primarily collected during the summer months (high insolation period) and stored on an annual basis for winter heating (low insolation period). The large storage system provided by nature allows economical storage of relatively low-temperature energy. A four-foot square collector was constructed and evaluated during the summer of 1980 under various weather conditions. Different combinations of black, clear, bubbled polyethylene sheets, for use above and below the shallow solar pond were

studied. Water flow rates varied from 17.8 lbm/hr to 151.7 lbm/hr. The temperature of water leaving the collector varied from 88°F during the worst weather conditions to 122°F during a clear day. Collector efficiencies up to 80 percent for the best combinations of polyethylene sheets and slightly over 50 percent for the worst combination were obtained. The life cycle cost analysis considers yearly replacement of the polyethylene liners, a complete replacement of the wooden frame after ten years, and a life expectancy of twenty years for wells and pumps. An energy cost of less than a dollar for 10^6 Btu is possible.

27885 **Performance data on multi-layer thermal curtains for greenhouses.** Rybczynski, W.; Bhatt, V. (McGill Univ., Montreal, Quebec). *Proceedings of the Annual Meeting - American Section of the International Solar Energy Society;* **4.1**: 22-24(1981). (CONF-810509—(Vol.1)). Philadelphia, PA, USA (26 May 1981).

The actual performance of low cost nighttime thermal curtain system which was developed as a prototype for Canadian crop greenhouses is described. An economic evaluation of this particular system based on life cycle costing is also presented.

27886 **Night shutter system for greenhouses in cold climates.** Schoenau, G.J.; Green, G.H.; Besant, R.W. Arinze, E.A. (Univ. of Saskatchewan, Saskatoon). *Proceedings of the Annual Meeting - American Section of the International Solar Energy Society;* **4.1**: 25-29(1981). (CONF-810509—(Vol.1)). Philadelphia, PA, USA (26 May 1981).

A night shutter system for greenhouses is described. The system was developed for double glazed quonset type greenhouses with shutter operating in between the glazings. Operation in between the glazings avoids problems due to weather experienced with outside shutters and condensation which can occur using shutters inside the greenhouse. The system is fairly simple to construct and can pay for itself within a year based on energy prices of $9.00/GJ.

27887 **Double glazing systems for greenhouses.** Sherry, W.J.; White, J.W. (Pennsylvania State Univ., University Park). *Proceedings of the Annual Meeting - American Section of the International Solar Energy Society;* **4.1**: 30-34(1981). (CONF-810509—(Vol.1)). Philadelphia, PA, USA (26 May 1981).

Utilization of double layer greenhouse glazing systems in place of single layer lapped glass significantly reduced heating requirements. Studies involving air-inflated twin layers of polyethylene or polyester, insulating glass, or extruded double layers of polycarbonate or polymethylmethacrylate indicated the potential for fossil fuel energy savings of 35 to 40% annually, compared to single skin lapped glass. Flux densities of solar radiation were also reduced significantly resulting in lower dry weight accumulations of chrysanthemums. Addition of a twin layer air-inflated polyethylene glazing system to existing glasshouses was also shown to be an effective energy conservation measure related to the floor area to exposed surface area ratio. Significant reductions in cut flower rose yields were observed under this glazing system which strongly indicated that this energy conservation technique is not an economically viable alternative for northern growers of high light requiring crops.

1410 Solar Collectors And Concentrators

27888 **(DOE/AL/13116—T1) Investigation of continuous deposition of AMA-type coatings onto strip and sheet by sputtering.** Thornton, J.A.; Lamb, J.L. (TELIC Corp., Santa Monica, CA (USA)). 1 Dec 1981. Contract AC04-80AL13116. 62p. (TELIC—81-3). NTIS, PC A04/MF A01. Order Number DE82004266.

In a previous program it was shown that Al_2O_3-Mo-Al_2O_3 coatings, with hemispherical absorptances (αH) of 0.90 to 0.95 and room temperature emittances of less than 0.10, and with promising thermal stability, could be deposited by magnetron sputtering. Coatings on Mo-coated glass and stainless steel substrates were stable in air to about 300°C when the Al_2O_3 layers were deposited by reactive sputtering, and to about 550°C when these layers were deposited by rf sputtering from an alumina target. The objective of the present program is to investigate the continuous deposition of such multilayer selective absorber coatings onto strip by planar magnetron sputtering. The work also involves investigating metal-layer materials, other than Mo, that might provide improved thermal stability in air. Cr, Mo, Ni, Ta, and a Pt/Al_2O_3 cermet have been examined for use as the intermediate metal layer. In each case the same metal was also used for the low emittance base layer. The substrates were glass and stainless steel plates. Good spectral selectivity, αH of 0.90 to 0.95 and emittance at 20°C of 0.10, has been achieved on glass substrates for all of the materials. The thermal stabilities of the coatings confirm the earlier work and underscore the importance of the Al_2O_3 layer. Coatings on glass substrates with rf sputtered Al_2O_3 layers were stable in air to 500 to 600°C and in vacuum to at least 650 to 700°C; they appear attractive for medium and high temperature collectors. The Mo and Ni-based coatings with reactive sputtering Al_2O_3 were stable during 1000 hr-long tests in air at 350°C and show promise as low-cost coatings for low-temperature (< 250°C) flat plate collector applications. Accordingly, Ni-based and Mo-based coatings are being investigated in the continuous deposition studies.

27889 **(TAC-STC—81-004) Solar thermal components: a bibliography with abstracts. Quarterly update, October-December 1981.** Bozman, W.R. (ed.). (New Mexico Univ., Albuquerque (USA). Technology Application Center). Jan 1982. 129p. University of New Mexico, Technology Application Center, Albuquerque 87131.

This annotated bibliography covers: material properties; flat plate collectors; concentrating collectors; heat pumps; coolers and dehumidifiers; heat exchangers; solar ponds; distillation and desalination; agricultural and industrial process heat; and irrigation pumps. Also included are an author index and a list of abbreviations and acronyms. (LEW)

27890 **Reliable method for rating solar collectors.** Lof, G.O.G.; Jones, D.; Shaw, L.E. (Solaron Corp. Englewood, CO). pp 216-225 of Solar engineering - 1981. Reid, R.L.; Murphy, L.M.; Ward, D.S. (eds.). New York, NY; American Society of Mechanical Engineers (1981).

From 3. annual systems simulation, economic analysis/solar heating and cooling operational results conference; Reno, NV, USA (27 Apr 1981).

A method is outlined which results in an accurate and meaningful rating of solar collectors in all parts of the country. The basis for the rating is a first order efficiency curve developed from test results obtained in an accredited laboratory by methods prescribed in the ASHRAE 93-77 procedure. Annual solar heat delivery per square foot of collector is then calculated for standard hot water and space heating applications in cities throughout the US by use of the F-CHART procedure. Four collectors are analyzed by the F-CHART method for space heating applications in five US cities at five solar load fractions. It is shown that although all the collectors have comparable outputs under some conditions, they perform quite differently in different parts of the country and at different ratios of collector area to heating load. It is also shown that two proposed rating methods based on computed all-day performance under clear-day conditions fail to provide valid comparisons between collectors and, in fact, may seriously mislead a prospective user in selecting a solar collector for a specific application in a particular location. The principal advantages of this proposed rating method over others are its validity in any locality and the fact that rating numbers are indicative of the actual amounts of energy collected. The information provides a basis for comparing solar with competing fuels and for comparing types and brands of solar collectors with each other.

1420 Heat Storage

27891 **(LBL—12100, pp 75-78) Aquifer thermal energy storage studies at LBL in 1980.** Tsang, C.F.; Buscheck, T.A.; Doughty, C. Jul 1981. NTIS, PC A12/MF A01. Order Number DE82000804.

In Earth Sciences Division annual report 1980.

The 1980 Aquifer Thermal Energy Storage (ATES) project includes four main tasks: (1) to solicit appropriate articles and to edit them for a quarterly International ATES Newsletter; (2) to perform ATES generic studies; (3) to carry out field-specific planning and simulation studies; and (4) to improve modeling techniques. This article describes the accomplishments and status of each of these four tasks.

27892 **Design and control tradeoffs for rockbins in passively solar heated houses with high solar fractions.** Vered, G.; Sebald, A.V. (Univ. of California, San Diego, La Jolla). pp 226-238 of Solar engineering - 1981. Reid, R.L.; Murphy, L.M.; Ward, D.S. (eds.). New York, NY; American Society of Mechanical Engineers (1981).

From 3. annual systems simulation, economic analysis/solar heating and cooling operational results conference; Reno, NV, USA (27 Apr 1981).

Performance of active and passive rockbins are compared in Albuquerque, NM, Santa Maria, CA, and Madison, WI. The basic house is assumed to contain both Trombe wall and direct gain. The latter are assumed to be optimally sized and controlled for each weather zone. It is demonstrated that rockbins can be used to advantage in reduction of the early morning auxiliary energy consumption peak common to passive houses with night setback thermostats. The paper also analyzes performance sensitivity to rockbin configuration (active, radiant slab top down charge, radiant slab bottom up charge), and to control strategies for charging and discharging. Effects of fan energy are included. New results on the thermal conductivity of passive rockbeds are outlined. These results are shown to be crucial to understanding the role of rockbins in passive houses.

27893 **Validation of a rock bed thermal energy storage model.** von Fuchs, G.F. (Boeing Computer Services Co., Tukwila, WA). pp 290-298 of Solar engineering - 1981. Reid, R.L.; Murphy, L.M.; Ward, D.S. (eds.). New York, NY; American Society of Mechanical Engineers (1981).

From 3. annual systems simulation, economic analysis/solar heating and cooling operational results conference; Reno, NV, USA (27 Apr 1981).

The development of a one dimensional rock bed model utilizing historical models and those used by current researchers is discussed. Heat transfer coefficients and assumptions, pressure drop, rock size and void fraction, axial conductivity, and other parameters are considered. Since the solution of the model differential equations can introduce instabilities and inaccuracies in the results, a discussion of the mathematical techniques used is included. The validation process consisted of formulating a test plan, instrumenting the rock bed, performing the tests then comparing the results with a simulation using the same parameters used in the test. Validation was quite good and is illustrated by several figures comparing observed and predicted axial temperature distributions. The sensitivity of the model to certain parameters is discussed, as well as the validity of a streamlined component simulation model which requires less computer time for operation.

27894 **(DOE/CS/35101—T1) Research on solar-energy-storage subsystems utilizing the latent heat of phase change of certain organic materials. Final report.** Bailey, J.A.; Mulligan, J.C.; Liao, C.K. (North Carolina State Univ., Raleigh (USA). Dept. of Mechanical and Aerospace Engineering). [nd]. Contract AS05-76CS35101. 211p. NTIS, PC A10/MF A01. Order Number DE81030688.

A survey of petroleum product manufacturers was conducted and a number of inexpensive organic materials of potential value for phase-change thermal energy storage were identified. Sunoco wax number 3420 was chosen for further work because of its desirable properties and low cost. An analytic procedure was formulated for modelling thermal capacitors whose intrastructure encapsulate the phase change material. Three such thermal capacitors were constructed and tested to validate the analytic procedure. (LEW)

15 GEOTHERMAL ENERGY

27895 **(PB—81-151615) Energy programs at the Johns Hopkins University Applied Physics Laboratory. Quarterly report, July-September 1980.** Yu, K.; von Briesen, R.; Tillman, J.E.; Paddsion, F.C.; Kane, S. (Johns Hopkins Univ., Laurel, MD (USA). Applied Physics Lab.). Nov 1980. Contract AIO1-79ET27025;EX-76-A-36-1008. 39p. NTIS, PC A03/MF A01.

The report is divided into four sections. The first, Geothermal Energy Development Planning and Technical Assistance contains reports on the progress of geothermal-related tasks on which effort was concentrated. The second section, Operational Research, Hydroelectric Power Development, contains reports on small-scale hydroelectric investigations in the southeastern states. The third section, Seismotectonic Investigations, reports on neotectonic investigations of the Manhattan Prong. The fourth section, Energy Conversion and Storage Techniques, contains three articles: an evaluation of the Einstein refrigerator, OTEC pilot plant performance calculations, and a study of landfill methane recovery.

1501 Resource Status And Assessment

REFER ALSO TO CITATION(S) 27661, 27909, 27921

27896 **Geothermal resources in arid and desert areas.** Barnea, J.; McNitt, J.H. pp 42-47 of Alternative strategies for desert development and management. Biswas, M.R.; Biswas, A.K. (eds.). Elmsford, NY; Pergamon Press (1982).

From International conference on desert development and management; Sacramento, CA, USA (31 May 1977).

Six types of geothermal resources are described briefly. The potential role and potential problems of geothermal resources in desert areas are discussed. (MHR)

27897 **Geothermal energy development in the desert: the case of Imperial Valley.** Edmunds, S.W. (Univ. of California, Riverside). pp 61-71 of Alternative strategies for desert development and management. Biswas, M.R.; Biswas, A.K. (eds.). Elmsford, NY; Pergamon Press (1982).

From International conference on desert development and management; Sacramento, CA, USA (31 May 1977).

Imperial Valley in California has the potential to develop about 4500 megawatts of power over the next 40 years, which will result in substantial fiscal and industrial development benefits while still not affecting the present rich agricultural base. The development planning process being used in Imperial Valley is described and may be utilized by other desert regions to develop their own geothermal resources. The total potential geothermal resources in the world are estimated at 1 billion megawatts, about equal to all the electrical energy installations now in place in the world. Much of the geothermal resources are located in the deserts of the world, making it possible for them to become major sources of energy in the future. In the process, the desert countries have the opportunity for industrial development and economic growth, similar to that described for Imperial Valley. The purpose, then, is to aid the desert regions of the world to plan the utilization of their geothermal resources and to describe the economic benefits which such development can bring.

1502 Geology And Hydrology Of Geothermal Systems

REFER ALSO TO CITATION(S) 27904, 27909

27898 (DOE/ET/27169—T1, pp 1-8) **Geothermal resources: an introduction with emphasis on low temperature reservoirs.** Rybach, L. (Inst. of Geophysics ETHZ, Zurich, Switzerland). Apr 1979. NTIS, PC A05/MF A01.

In Symposium on geothermal energy and its direct uses in the eastern United States. Special report No. 5.

Geothermal background to describe low-temperature reservoirs is presented. The performance of thermal springs is described and production from deep aquifers and hot dry rocks is discussed in

terms of heat content, permeability and reservoir lifetime. Environmental aspects are addressed which show that geothermal energy extraction will cause no climatic effects. Chemical effects are the most significant ones; more basic research is needed to predict the long-term chemical performance of geothermal systems.

27899 (DOE/ET/27169—T1, pp 9-12) **General geology of the east coast with emphasis on potential geothermal energy regions: a detailed summary.** Glover, L. III. (Virginia Polytechnic Inst. and State Univ., Blacksburg). Apr 1979. NTIS, PC A05/MF A01.

In Symposium on geothermal energy and its direct uses in the eastern United States. Special report No. 5.

The evolution of the structure, composition, age and intensity of the metamorphism and of granite emplacement is presented. The heat production of rocks in the basement under the Atlantic Coastal Plain is discussed. (MHR)

27900 (DOE/ET/27169—T1, pp 31-36) **Cenozoic and Mesozoic aquifer systems of the Atlantic coastal plain.** Brown, P.M. (Geological Survey, Raleigh, NC). Apr 1979. NTIS, PC A05/MF A01.

In Symposium on geothermal energy and its direct uses in the eastern United States. Special report No. 5.

In areas such as the Atlantic Coastal Plain, where suspected crustal heat sources have not yet been fully documented, the geothermal potential of aquifer systems may, in the absence of a known heat source, and in part, be quantified, on the basis of geologic information, for comparative, region-wide, screening purposes. The basic geologic information required is (1) that which defines the regional structural-stratigraphic framework and the manner in which it controls the position and composition of aquifer systems present in the sediment mass, and (2) that which delineates aquifer systems and their component parts. This information is discussed in some detail.

27901 (DOE/ET/27169—T1, pp 37-42) **Reservoir engineering and evaluation.** Mercer, J.W.; Faust, C.R. (Geological Survey, Reston, VA). Apr 1979. NTIS, PC A05/MF A01.

In Symposium on geothermal energy and its direct uses in the eastern United States. Special report No. 5.

The process of modeling a hydrothermal system is described. The general governing equations consist of mass, momentum, and thermal energy balances for each phase present in a geothermal system. Using a set of constitutive relationships, these balance equations may be reduced to two or three nonlinear partial differential equations. (MHR)

27902 (LBL—12100, pp 8-12) **State-of-the-art models for geothermal recovery processes.** Tsang, C.F.; Wang, J.S.Y. Jul 1981. NTIS, PC A12/MF A01. Order Number DE82000804.

In Earth Sciences Division annual report 1980.

A few key two-phase models are reviewed and compared to illustrate the present state of the art. These models are: CCC, O'Neill, Coats, Faust-Mercer, MUSHRM, SHAFT79, Thomas-Pierson, Voss-Pinder, and Toronyi-Ali. (MHR)

27903 **Geopressured geothermal ground-water resources in desert regions.** Jones, P.H. (Louisiana State Univ., Baton Rouge). pp 48-51 of Alternative strategies for desert development and management. Biswas, M.R.; Biswas, A.K. (eds.). Elmsford, NY; Pergamon Press (1982).

From International conference on desert development and management; Sacramento, CA, USA (31 May 1977).

The principles of occurrence of geopressure, the origin of geopressure, and geopressure-geotemperature relationships are discussed. (MHR)

1503 Geothermal Exploration And Exploration Technology

Technology

27904 (DOE/ET/27169—T1, pp 13-22) **Geothermal exploration methods and results: Atlantic coastal plain.** Costain, J.K. (Virginia Polytechnic Inst. and State Univ., Blacksburg). Apr 1979. NTIS, PC A05/MF A01.

In Symposium on geothermal energy and its direct uses in the eastern United States. Special report No. 5.

The geophysical techniques used to investigate the geologic framework of potential geothermal resources of parts of the eastern United States are discussed briefly. Geothermal resources in the Appalachian Mountain system and the Atlantic Coastal Plain can be grouped into four types: I) Radiogenic heat-producing granite buried beneath a thick blanket of sediments of low thermal conductivity, II) Normal geothermal gradient resources, III) Warm water emanating from fault zones, IV) Hot-dry-rock in regions of abnormal geothermal gradient. Resource I is the principal subject of this paper.

27905 (DOE/ET/27169—T1, pp 23-24) **Geothermal exploration methods and results: inland states.** Maxwell, J.C. (Los Alamos Scientific Lab., NM). Apr 1979. NTIS, PC A05/MF A01.

In Symposium on geothermal energy and its direct uses in the eastern United States. Special report No. 5.

The Los Alamos Scientific Laboratory (LASL) geothermal exploration sequence includes: (a) review of AAPG/USGS gradient maps, (b) literature search, (c) consideration of potential markets, (d) groundwater silica geothermometry, (e) analysis of bottom-hole temperatures, (f) heat flow measurement of available wells, and (g) drilling of new test holes. This procedure has located anomalies near Syracuse, NY (36°C/km, 56°C silica max.), near Buffalo, NY (36°C/km, 65°C silica max.), southeast Ohio, western and southwestern Nebraska, and three new warm springs in Arkansas. Other investigations have found high heat generation (14 to 25 HGU) in the White Mountain batholith NH (170°C calculated at 6 km depth), uparching of the Adirondac Dome, NY, and potentially economic electricity from hot brines in southwest Arkansas.

27906 (DOE/ET/27169—T1, pp 25-30) **Geothermal exploration and development drilling programs for 50 heat flow holes and a deep test well.** Lane, R.N. Apr 1979. NTIS, PC A05/MF A01.

In Symposium on geothermal energy and its direct uses in the eastern United States. Special report No. 5.

The management and drilling techniques used to drill 50 heat flow measurement holes on the Atlantic Coastal Plain between July 1, 1978 through January 28, 1979 are described. The organization and logistic support required for this effort are shown to be more important than drilling techniques for these shallow holes. The plans for a geothermal test well near Crisfield, MD are described in some detail.

27907 (DOE/ET/27169—T1, pp 43-48) **Hot dry rock program in the eastern US.** Pettitt, R.A. (Los Alamos Scientific Lab., NM). Apr 1979. NTIS, PC A05/MF A01.

In Symposium on geothermal energy and its direct uses in the eastern United States. Special report No. 5.

In the concept developed by LASL, a man-made geothermal reservoir is formed by drilling a deep hole into relatively impermeable hot rock, creating a large surface area for heat transfer by fracturing the rock with hydraulic pressure, then drilling a second hole to intersect the fracture to complete the circulation loop. Such a demonstration system has been completed at Fenton Hill in north-central New Mexico, at a depth of 3050 m (10,000 ft) and a bottom-hole temperature of 205°C (402°F). The system has been successfully circulated for approximately 2800 h to determine temperature drawdown, permeation water loss and flow characteristics of the pressurized reservoir, to examine chemistry changes in the circulating fluid, and to monitor for induced seismic effects. As a result of these successful experiments, a national program for development of the hot dry rock potential is now being conducted by LASL. Additional sites are being evaluated in the US for prospective demonstration plants. Two of the most promising eastern locations at this time appear to be northcentral New York State and the eastern

shore of Maryland and Virginia. Hot dry rock sites in the east will probably closely follow the technology developed in New Mexico - at least for the first several projects. Several areas in the east have geothermal gradients that are high enough to be considered for electrical power generation, as well as nonelectrical uses.

27908 (DOE/ET/27169—T1, pp 99-101) **Prospectus for geothermal energy: the Atlantic Coastal Plain.** Paddison, F.C. (Johns Hopkins Univ., Laurel, MD). Apr 1979. NTIS, PC A05/MF A01.

In Symposium on geothermal energy and its direct uses in the eastern United States. Special report No. 5.

The Department of Energy is targeting and evaluating the not-so-obvious geothermal resource areas under the Atlantic Coastal Plain. These potential hydrothermal resources turn out to be areas of reasonable size from the State of New Jersey to the State of Georgia. The resources are evidenced by higher-than-normal thermal gradients; however, the sedimentary sequences are of limited depth, so that the expected temperatures at the bottom of the sedimentary pile are such that use will be limited to direct (nonelectric) applications. A survey of the northern half of the Coastal Plain established the potential market for moderate temperature geothermal energy. This effort is being followed in each resource area by the preparation of a how-to-apply prospectus or scenario. Since each state is unique in its resource characteristics, its laws, regulations, environmental concerns and, further states differ in their method of planning for accommodating new energy forms and economic development of state and counties. The prospectus is accordingly prepared either by, or with the assistance of, local agencies. The prospectus outlines the applications engineering, and economic considerations and a road map through the institutional, environmental and legal requirements for his particular use. Finally, the prospectus identifies those issues which are yet to be resolved, either by the federal, state or local government. There results, therefore, a planning document with enough detail so that a potentially interested user (entrepreneur) can assess the resource's potential to his needs.

27909 (DOE/ID/01601—T4) **Final report: geothermal exploration in Utah.** (Utah Univ., Salt Lake City (USA). Dept. of Geology and Geophysics). Feb 1979. Contract AS07-76ID01601. 67p. NTIS, PC A04/MF A01. Order Number DE82003937.

During the performance period of the contract, 15 volumes of topical reports and 21 volumes of final technical reports were issued concerning geothermal exploration. These reports are listed. In this ultimate volume of the final technical report, abstracts of all reports, a summary of the highlights of achievements under these reports, and copies of published papers which acknowledge financial support from the contract are included.

27910 (DOE/ID/12079—27) **Lithology and well-log study of Campbell E-2, geothermal test well, Humboldt House geothermal prospect, Pershing County, Nevada.** Sibbett, B.S.; Glenn, W.E. (Utah Univ., Salt Lake City (USA). Research Inst.). Aug 1981. Contract AC07-79ID12079. 36p. NTIS, PC A03/MF A01. Order Number DE82003951.

In light of the cuttings and geophysical logs from the Campbell E-2 hole, it seems unlikely that a geothermal reservoir exists in the horst block of the Humboldt House area. All known sinter deposits occur in the graben block in the valley, northwest and southwest of Campbell E-2. The range front fault, which may serve as a conduit for deeply circulating fluids, dips to the west and intersects the hole at 890 feet (271.3 m). The presence of sinter deposits and the deeper extension of the fault to the west suggest that the geothermal system may be located to the west of the Campbell E-2 hole. The Grass Valley Formation and the Auld Lange Syne Group in general are fine-grained argillaceous and slaty rocks these rocks have a very low intergranular permeability and may not be competent enough to maintan a significant fracture permeability necessary for a geothermal reservoir rock.

27911 (DOE/ID/12079—32) **MAG2D: Interactive 2-1/2-dimensional magnetic modeling program (User's Guide and Documentation for Rev. 1).** Nutter, C. (Utah Univ., Salt Lake City (USA). Research Inst.). Apr 1981. Contract AC07-79ID12079. 88p. (ESL—56). NTIS, PC A05/MF A01. Order Number DE82003948.

MAG2D is an interactive computer program used for modeling 2-1/2-dimensional magnetic data. A forward algorithm is used to give the theoretical attraction of magnetic intensity at a station due to a perturbing body given by the initial model. The resultant model can then be adjusted for a better fit by a combination of manual adjustment, one-dimensional automatic search, and Marquardt inversion. MAG2D has an interactive data management system for data manipulation and display built around subroutines to do a forward problem, a one-dimensional direct search and an inversion. These subroutines were originally separate batch-mode programs.

27912 (DOE/ID/12079—36) **Interpretation of drill cuttings from geothermal wells.** Hulen, J.B.; Sibbett, B.S. (Utah Univ., Salt Lake City (USA). Research Inst.). Jun 1981. Contract AC07-79ID12079. 25p. (ESL—57). NTIS, PC A02/MF A01. Order Number DE82003947.

Problems in interpreting drill cuttings, as opposed to drill cores, and methods to solve these problems are outlined. The following are covered: identification of lithology; recognition of faults and fractures; interpretation of hydrothermal alteration; geochemistry; sample collection; sample preparple examination; and sample storage. (MHR)

27913 (DOE/ID/12079—37) **Analysis of geothermal electric-power generation at Big Creek Hot Springs, Lemhi County, Idaho.** Struhsacker, D.W. (ed.). (Utah Univ., Salt Lake City (USA). Research Inst.; EG and G Idaho, Inc., Idaho Falls (USA); Idaho State Office of Energy, Boise (USA)). Jan 1981. Contract AC07-79ID12079. 71p. (ESL—58). NTIS, PC A04/MF A01. Order Number DE82003946.

Big Creek Hot Springs was evaluated as a source of electrical power for the Blackbird Cobalt Mine, approximately 13 miles south of the hot spring. An evaluaton of the geothermal potential of Big Creek Hot Springs, a suggested exploration program and budget, an engineering feasibility study of power generation at Big Creek Hot Springs, an economic analysis of the modeled power generating system, and an appraisal of the institutional factors influencing development at Big Creek Hot Springs are included.

27914 (LBL—12100, pp 54-56) **Geochemical assessment of five potential sites for hydrothermal magma systems.** White, A.F. Jul 1981. NTIS, PC A12/MF A01. Order Number DE82000804.

In Earth Sciences Division annual report 1980.

Five potential sites for deep drilling in hydrothermal - magma site were investigated. The sites are The Geysers-Clear Lake area, California, Long Valley, California, Salton Trough, California, Roosevelt Hot Springs, Utah, and the Rio Grande Rift, New Mexico. The results of geochemical evaluations of these areas is summarized. (ACR)

27915 (LBL—12100, pp 57-59) **Deep electromagnetic crustal sounding in northern Nevada.** Wilt, M.J.; Goldstein, N.E.; Morrison, H.F.; Haught, J.R. Jul 1981. NTIS, PC A12/MF A01. Order Number DE82000804.

In Earth Sciences Division annual report 1980.

The Battle Mountain heat-flow high, situated in north-central Nevada, covers several thousand square miles in five counties. This region is characterized by an average heat flow that is twice the continental average and by a number of geothermal anomalies. Geologically this area is known for its high elevation, frequent earthquakes, fairly recent volcanism, and the presence of numerous thermal springs. There are also suggestions of continental spreading and abundant evidence of recent faulting. Magnetotelluric surveys in northern Nevada and Idaho have indicated the presence of low-resistivity zones as shallow as 10 km and at a depth of 15 km throughout the region. To confirm the magnetotelluric results and to map the low-resistivity zones in greater detail, a deep electro-

magnetic induction sounding experiment was undertaken in north-central Nevada. Buena Vista Valley in north central Nevada was chosen as the field site for the experiment.

27916 (LBL—12100, pp 85-89) **Exploration technology.** Morrison, H.F.; Haught, J.R.; Hoversten, G.M.; Mozley, E.C. Jul 1981. NTIS, PC A12/MF A01. Order Number DE82000804.

In Earth Sciences Division annual report 1980.

The following research was discussed: a controlled-source electromagnetic interpretation based on a tilted dipole source, transient field responses, the approximation of magnetotelluric topographic effects by the solution of Laplace's equation and the utilization of magnetotelluric polar diagrams in a volcanic environment. (MHR)

27917 (LBL—12100, pp 89-93) **Electromagnetic induction sounding at geothermal prospects in Nevada.** Wilt, M.J.; Stark, M.; Goldstein, N.E.; Haught, J.R. Jul 1981. NTIS, PC A12/MF A01. Order Number DE82000804.

In Earth Sciences Division annual report 1980.

Controlled-source electro-magnetic sounding surveys were conducted with the newly developed EM-60 system over three promising geothermal targets in northern Nevada. These are (1) Panther Canyon, an area in the southeastern portion of Grass Valley; (2) the Soda Lake geothermal area, located near Fallon, Nevada; and (3) the McCoy geothermal region, located some 30 miles west of Austin in central Nevada. Significant findings from each survey are summarized.

27918 **(PB—81-147308) Well engineering and sampling variables in the evaluation of geobrines. Report of investigations/1980.** Riley, W.D.; Walters, R.P.; McCawley, F.X.; Conner, G.R.; Needham, P.B. Jr. (Bureau of Mines, Avondale, MD (USA). Avondale Research Center). 1980. 25p. NTIS, PC A02/MF A01.

An analytical program has been conducted at the Avondale Research Center to determine the chemical constituents of some high- and low-salinity geobrines found in the Imperial Valley of California. Data are reported for the early stages of brine production of four geothermal wells--the low-salinity, medium-enthalpy brines from the East Mesa Known Geothermal Resource Area (KGRA), Mesa 6-1 and 6-2, and the high-salinity, high enthalpy brine from the Salton Sea KGRA, Magmamax 1 and Woolsey 1.

1504 Legal And Institutional Aspects

REFER ALSO TO CITATION(S) 27913

1505 Economic And Financial Aspects

27919 (DOE/ET/27169—T1, pp 87-94) **Geothermal energy markets on the Atlantic coastal plain.** Toth, W.J. (Johns Hopkins Univ., Laurel, MD). Apr 1979. NTIS, PC A05/MF A01.

In Symposium on geothermal energy and its direct uses in the eastern United States. Special report No. 5.

A Geothermal Energy Market Study (GEMS) has been performed in four selected areas on the Atlantic Coastal Plain. The GEMS efforts have fallen into two categories: market definition, wherein current requirements for thermal energy are assessed, and market penetration, wherein the economics are investigated and projections are made of the extent to which geothermal energy will be used in the defined markets. In the market definition phase, a survey and analysis of potential energy markets for low- to moderate-temperature (up to 250°F) geothermal resources has been completed for southeastern New Jersey, the Delmarva Peninsula, the Norfolk area of Virginia, and for eastern North Carolina. Data have been obtained and analyzed for space and water heating requirements in the residential, commercial and military sectors and for crop drying and space heating requirements in the agricultural sector. In addition, over five hundred companies in the four areas have been contacted for information on energy consumption, and about 175 of these companies have been identified as having process heat requirements that could be satisfied by potential geothermal resources.

27920 (DOE/ET/27169—T1, pp 95-98) **Cost analysis of hydrothermal resource applications in the Atlantic coastal plain.** Weissbrod, R.; Barron, W. (Johns Hopkins Univ., Baltimore, MD). Apr 1979. NTIS, PC A05/MF A01.

In Symposium on geothermal energy and its direct uses in the eastern United States. Special report No. 5.

In order to accommodate changing resource and economic conditions and to estimate locally specific average costs, a computer simulation model was developed for the study of low temperature hydrothermal resources and the costs of developing and using those resources. The cost estimates derived from the model give an indication of the potential competitiveness of low temperature hydro resources relative to the costs of traditional space heating and process heating fuels. The model was described briefly, and then some of the cost estimates under varying resource and economic conditions are presented. The sensitivity of changing different input conditions is outlined.

27921 **(PB—82-123050) Geothermal energy market study on the Atlantic Coastal Plain: Ocean City, Maryland geothermal energy evaluation.** Schubert, C.E. (Coordinating Center Models Project, Baltimore, MD (USA)). Aug 1981. 53p. NTIS, PC A04/MF A01.

This report is one of a series of studies that have been made by the Applied Physics Laboratory, or its subcontractors, to examine the technical and economic feasibility of the utilization of geothermal energy at the request of potential users.

1508 Geothermal Power Plants

REFER ALSO TO CITATION(S) 27913

27922 **Electrical production from modeate-temperature geothermal brines.** Jacobs, H.R.; Boehm, R.F. (Univ. of Utah, Salt Lake City). *Journal of Energy Resources Technology;* **101**: No. 2, 134-140(Jun 1979).

Direct contact binary cycles may be used to develop electrical power from moderate temperature geothermal brines. For a simple Rankine cycle using direct contact heat exchangers isobutane is preferred as a working fluid for brines at temperatures greater than 138°C. Pentane appears more attractive at lower temperatures. For all moderate temperature applications, however, the use of bottoming cycles, multi-turbine, multi-fluid cycles, yields significantly better performance. 12 references, 11 figures, 3 tables.

1509 Geothermal Engineering

REFER ALSO TO CITATION(S) 27898

27923 **(PB—81-970819) Cements for geothermal wells: new cementing materials promise to sithstand the stresses of geothermal wells. NTIS tech note.** (Department of Energy, Washington, DC (USA)). Nov 1981. 1p. For information about subscribing to Tech Notes, please write NTIS Subscription Dept.

This citation summarizes a one-page announcement of technology available for utilization. New high-temperature hydrothermally-cured cement formulations are being developed for securing steel casings in geothermal wells. The goal of the program is to formulate cements that can withstand high-temperature, high-pressure, and often corrosive environments, which degrade portland cements. The program represents the most comprehensive and thorough examination of the geothermal cementing problem undertaken thus far. The characterization of 26 cements identified in the R. and D. phase or supplied by industry and foreign users is in progress at the National Bureau of Standards. ...FOR ADDITIONAL INFORMATION: Contact: Dr. Lawrence E. Kukacka, Department of Energy and Environment, Brookhaven National Laboratory, Upton, NY 11973. Telephone (516) 345-3065.

1510 Direct Energy Utilization

27924 (DOE/ET/27169—T1, pp 49-54) **Worldwide direct application review.** Lund, J.W. (Oregon Inst. of Tech., Klamath Falls). Apr 1979. NTIS, PC A05/MF A01.

In Symposium on geothermal energy and its direct uses in the eastern United States. Special report No. 5.

Direct utilization of geothermal energy has been used by many countries in the past on a small scale for bathing, cooking, and heating. Today, there are still many small-scale individual uses, however, many large-scale projects have been developed for district heating, greenhouse complexes and industrial processing. The number of large-scale projects will continue to grow due to the escalation of fossil fuel costs and the proven technology of using insulated transmission lines and efficient heat exchangers for geothermal fluids. Today, 7050 MW (thermal) of geothermal energy are used in direct applications, mainly in Iceland, New Zealand, USSR, Japan, and Hungary. In all cases, the cost of geothermal utilization is below that of comparable fossil fuel energy.

27925 (DOE/ET/27169—T1, pp 55-58) **Urban heating from geothermal aquifers in the Paris basin.** Rybach, L. (Inst. of Geophysics ETHZ, Zurich, Switzerland). Apr 1979. NTIS, PC A05/MF A01.

In Symposium on geothermal energy and its direct uses in the eastern United States. Special report No. 5.

A total of 10,000 apartments are heated at present by combining the geothermal source with auxiliary boilers and heat pumps in an area of normal geothermal conditions (average geothermal gradient 33°C/km = 1.8°F/100 ft.). The geothermal contribution which supplies domestic hot water as well amounts to about 70% of the total heat consumed. The resource consists of a deep aquifer (porous Dogger limestone). Due to the high salinity of the formation water (up to 25 g/L) produced, reinjection is necessary. This is performed by the doublet system which consists of a twin well (production-reinjection). Typical production rates are 100 m^3/h (440 gpm) at 60 to 70°C (140 to 158°F). Noticeable temperature drawdown at the production well is not expected before 30 years. Economic analysis shows that the geothermal system is slightly less expensive (at 1977 fuel prices) than conventional fossil-fuel schemes. The French authorities strongly support this development (the risk of the production well is covered by the government) which aims at 800,000 geothermally-heated apartments in the Paris basin by 1990.

27926 (DOE/ET/27169—T1, pp 59-62) **Fluid heat management for direct geothermal energy applications.** Kunze, J.F. (Energy Services, Inc., Rexburg, ID). Apr 1979. NTIS, PC A05/MF A01.

In Symposium on geothermal energy and its direct uses in the eastern United States. Special report No. 5.

The problem of utilizing the geothermal fluid as economically as possible in direct applications of geothermal energy is addressed. The lower temperature uses are primarily addressed, since these are the only ones likely to make a significant impact in the eastern United States.

27927 (DOE/ET/27169—T1, pp 63-64) **Geothermally pasteurized milk process.** Belcastro, E. (Medo-Bel Creamery Inc., Klamath Falls, OR). Apr 1979. NTIS, PC A05/MF A01.

In Symposium on geothermal energy and its direct uses in the eastern United States. Special report No. 5.

The use of geothermal fluids to supply heat to pasteurize milk is described. The well, the circulation system and the corrosion problems are described. (MHR)

27928 (DOE/ET/27169—T1, pp 65-68) **Channel Catfish (Ictalurus punctatus) production in geothermal water.** Ray, L. (Fish Breeders of Idaho, Buhl). Apr 1979. NTIS, PC A05/MF A01.

In Symposium on geothermal energy and its direct uses in the eastern United States. Special report No. 5.

Fish Breeders have been raising Channel Catfish (Ictalurus punctatus) in geothermal facilities for six years. The product produced is superior to other catfish on the market. Concrete facilities and 6,000,000 gallons per minute of water allow densities of five to ten pounds per cubic foot of space and 10,000 pounds per second foot of water. Oxygen and ammonia are the principle factors limiting production. Disease is related to these factors. Identifying the resource, facility design, financing, construction, production, processing, marketing and distribution are the main problem areas preventing expansion of geothermal fish farming.

27929 (DOE/ET/27169—T1, pp 69-70) **Use of geothermal fluids to heat a large greenhouse complex.** Boren, K.L. Apr 1979. NTIS, PC A05/MF A01.

In Symposium on geothermal energy and its direct uses in the eastern United States. Special report No. 5.

Geothermal fluids are being used to heat 30 greenhouses near Susanville, in Northeastern California. Cucumbers and tomatoes are grown in a hydroponic system requiring no root medium such as dirt or gravel. A high quality ground water supply is used for irrigation, while a shallow geothermal well supplies hot water for the heat-exchange type heaters. Thermostats and humidistats control the greenhouse environment. Nutrients are supplied in the irrigation water circulated through the root system that is contained in polyethylene growing tubes. A high quality fruit is produced and sold in the Los Angeles market. The complex has been planned for expansion to 205 greenhouses, and the next units are scheduled for construction this year.

27930 (DOE/ET/27169—T1, pp 71-72) **Thermal water of Hot Springs National Park, Arkansas: their origin, nature, and implication for the geothermal development.** May, L.A.; Stringer, E.; Goodman, B. (National Park Service, Hot Spring National Park, AR). Apr 1979. NTIS, PC A05/MF A01.

In Symposium on geothermal energy and its direct uses in the eastern United States. Special report No. 5.

The 47 hot springs have a combined flow of approximately 1,000,000 gallons per day at 143° fahrenheit. Source of the hot springs artesian-flow system is by infiltration of rainfall in the outcrop area of the Bigfork chert, the Arkansas Navaculite, sandstones and shales with the water emerging after 4400 years. The radioactivity through radon gas emanation is 0.81 millimicocuric per liter. Chemical analysis is given in milligrams per liter. Existing water usage is for heating restrooms, Administration Building and therapeutic bathing as known world wide in Hot Springs, Garland County, Arkansas.

27931 (DOE/ET/27169—T1, pp 73-80) **Utilization of geothermal energy with an emphasis on heat pumps.** Niess, R.C. Apr 1979. NTIS, PC A05/MF A01.

In Symposium on geothermal energy and its direct uses in the eastern United States. Special report No. 5.

Since 1975 low temperature waste heat sources (such as water normally cooled in cooling towers) have increasingly been used in conjunction with heat pumps for hot water production and space heating. This same concept can be applied to a low temperature geothermal source to amplify the temperature to a usable value or amplify the amount of energy that can be usefully extracted from a limited geothermal resource. There is interest in the application of industrial water-to-water heat pumps for use with geothermal water in the 60 degrees to 120 degrees Fahrenheit range, considered available from wells less than 3000 feet deep. The heat in this water can then be temperature amplified to increase the deliverable temperature by as much as 80 degrees to 90 degrees Fahrenheit. The heat pump can be economically used either a) to upgrade a geothermal resource already obtained where the flow and/or temperature are insufficient to meet the utilization needs, or b) as an alterative to drilling much deeper wells to obtain needed higher use temperatures.

27932 (DOE/ET/27169—T1, pp 81-86) **Direct heat activated cooling adapted to geothermal energy.** Ingle, W.D. III. (Arkla Industries Inc., Evansville, IN). Apr 1979. NTIS, PC A05/MF A01.

In Symposium on geothermal energy and its direct uses in the eastern United States. Special report No. 5.

Development in recent years of direct low temperature heat operated cooling equipment has the potential of improving geother-

mal economics by enabling more uniform seasonal load distribution and capital amortization. Source temperatures below 200°F and improved auxiliary power consumption are the primary advantages over previously available equipment. Of the various types of equipment on which development was undertaken, only absorption is beyond the developmental stage, being in current volume production. Availability of these advanced absorption machines in small tonnage capacities (as low as 3 tons) facilitates the undertaking of demonstration projects at greatly reduced costs, freeing R & D monies for instrumentation, analysis and reporting expenses.

27933 **(TRW—97248000) Use of geothermal heat for sugar refining in Imperial County: environmental assessment and monitoring plan.** (TRW Energy Systems Group, Redondo Beach, CA (USA)). Dec 1979. Contract AC03-79ET27039. 22p. NTIS, PC A02/MF A01. Order Number DE82004752.

This environmental monitoring and reporting plan is based on requirements set by the State of California, Water Quality Control Board, and the Division of Oil and Gas as well as special requirements by the County of Imperial, Air Pollution Control Board and other county offices. This plan addresses all of the applicable environmental impacts identified in the Final Environmental Report. Each item of the environmental monitoring and reporting requirements is addressed in terms of (a) impact; (b) mitigation measures and/or engineering practices; and (c) monitoring and reporting requirements. An overall summary of all of the reporting requirements is contained.

27934 **Utilization of geothermal brackish water for the production of out-of-season crops in the Negev Desert.** Pasternak, D. (Ben-Gurion Univ. of the Negev, Berrsheba, Israel); Rappaport, E.; Twersky, M.; Borovic, I.; de Malach, Y. pp 52-60 of Alternative strategies for desert development and management. Biswas, M.R.; Biswas, A.K. (eds.). Elmsford, NY; Pergamon Press (1982).

From International conference on desert development and management; Sacramento, CA, USA (31 May 1977).

A technology for the utilization of low temperature (25 to 50°C) geothemal water for soil and space heating is described. Soil heating is carried out by passing warm water through polyethylene pipes buried in the soil. Greenhouse space heating is achieved by running a film of warm water between the two clear layers which comprise the greenhouse roof. In both cases temperature is regulated by the flow of water. A system for growing out-of-season crops in the field or in greenhouses with the aid of soil and air heating is described. Raising soil temperatures from 14°C to 30°C increased cucumber yields from 6.4 to 15.3 kg m^{-2}. Utilization of geothermally heated greenhouses made possible the production of winter cucumbers and melons in the Central Negev.

1520 Geothermal Data And Theory

REFER ALSO TO CITATION(S) 27918

27935 (LBL—12100, pp 34-40) **Behavior of rock-fluid systems at elevated temperatures and pressures.** Somerton, W.H. Jul 1981. NTIS, PC A12/MF A01. Order Number DE82000804.

In Earth Sciences Division annual report 1980.

Work is reviewed in three areas: pore and bulk compressibilities and thermal expansions, absolute permeability, and thermal conductivity. (ACR)

27936 (LBL—12100, pp 41-43) **Results of albite solubility measurements as a function of temperature (125 to 350°C).** Neil, J.M.; Apps, J.A. Jul 1981. NTIS, PC A12/MF A01. Order Number DE82000804.

In Earth Sciences Division annual report 1980.

Understanding the solubility of the major rockforming minerals in low-temperature, hydrothermal environments is important for successful modeling of diagenetic, metasomatic, and metamorphic processes; for predicting the effects of returning cooled, geothermal brines to their reservoirs; or for using aquifers for hot-water storage. This report summarizes the results of a series of experiments to measure albite solubility in pure water and in 10^{-3} and 10^{-2} N NaCl solutions with temperature as the experimental variable.

27937 (LBL—12100, pp 48-51) **Viscosity of NaCl, KCl, and $CaCl_2$ solutions up to 350°C and 50 MPa.** Phillips, S.L.; Ozbek, H.; Igbene, A.; Litton, G. Jul 1981. NTIS, PC A12/MF A01. Order Number DE82000804.

In Earth Sciences Division annual report 1980.

The results of a review of the available data on the viscosity of sodium chloride, potassium chloride, and calcium chloride solutions are summarized for the following ranges of geothermal conditions: temperatures up to 350°C, pressures up to 50 MPa, and concentrations up to 5 m (27 wt%). (ACR)

16 TIDAL POWER

1608 Wave Energy Converters

27938 **(BMFT-FB-T—81-117) Technology and application of wave power. System study.** Eckener, U.; Kroeger, T.; Dursthoff, W. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). 1979. 393p. (In German). Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.).

In this study, the technical and economic feasibility of the use of wave power is examined. Special emphasis was placed on the requirements of decentralised energy supply for developing countries. Result: The most suitable and least costly applications are those, in which the wave energy is directly used to drive a pump, feeding a storage power station, a reverse osmosis plant or a marine pond for the production of bio fuel. The generation of electric power directly by the wave energy converter is also possible. The most promising device up to 1000 kW is a semi submersible buoy which - evolved from the same basic design - has been outlined in a pumping and a electricity generating version.

17 WIND ENERGY

REFER ALSO TO CITATION(S) 27810, 27813

1701 Availability (climatology)

27939 **Wind energy in desert areas.** Hughes, W.L. (Oklahoma State Univ., Stillwater). pp 30-41 of Alternative strategies for desert development and management. Biswas, M.R.; Biswas, A.K. (eds.). Elmsford, NY; Pergamon Press (1982).

From International conference on desert development and management; Sacramento, CA, USA (31 May 1977).

Wind resources in Egypt are evaluated both in quantity and in quality. These areas of interest are discussed: the north coastal areas, the Red Sea coastal areas, and the desert interior areas. Operational experience of windpower units in sandstorms and high velocity winds is discussed. (MHR)

1704 Economics

27940 **(FFA-TN-AU—1577-PT-2) L-180 Poseidon: A system concept in vertical axis turbine technology, Part 2.** Ljungstroem, O. (Flygtekniska Foersoeksanstalten, Stockholm (Sweden)). Oct 1980. 33p. NTIS, PC A03/MF A01.

From Presented at 3rd Intern. Symp. on Wind Energy Systems; Copenhagen, Denmark (Aug 1980).

An offshore 20MW L blade system with 180 m dia troposkien shaped blades was studied. The L-blade system uses two vertical, curved blades mounted on a cantilever tower at a 90 deg angle relative to each other (in plane of rotation), thus forming an L, looking from the top. Considerable reduction of the oscillating wind loads on the rotor-lower structure is realized in comparison with conventional two bladed Darrieus turbines resulting in reduced system weight and cost. Parking loads in extreme winds are

also reduced favorably. Weight and cost estimates for farms of 10 or more offshore units are given.

1706 Wind Energy Engineering

REFER ALSO TO CITATION(S) 27812

27941 **(DOE/NASA/0203—1) Development report: automatic system test and calibration (ASTAC) equipment.** Thoren, R.J. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center; Paragon Pacific, Inc., El Segundo, CA (USA)). Jul 1981. Contract AI01-76ET20320. 25p. (NASA-CR—165403; PPI—3009-4). NTIS, PC A02/MF A01. Order Number DE82004723.

The Automatic System Test and Calibration (ASTAC) Equipment has been developed by Paragon Pacific, Inc. to be used in conjunction with the NASA Lewis Research Center Wind Energy System Time-Domain (WEST) Analyzer. ASTAC is used to monitor the performance of the WEST Analyzer and to identify component malfunctions which may occur from time to time within WEST. The heart of the ASTAC system is a microcomputer which is used to input prescribed test signals into all WEST subsystems via a hybrid interface unit, and to process WEST output responses to these test signals. Measured responses are compared to theoretical levels calculated off-line using specialized ASTAC software. This report describes the microcomputer, the interface unit and the software packages which in total comprise the ASTAC system. Examples of ASTAC test results obtained on the WEST Analyzer are presented and described in detail. In addition, a section has been included which briefly describes the methods by which the microcomputer and interface unit can be maintained.

27942 **UTRC 8-kw wind-turbine tests.** Cheney, M.C. (United Technol Res Cent, East Hartford, Conn, USA). *Journal of Energy;* **5**: No. 2, 122-128(Mar 1981).

Prototype testing demonstrated the basic operation of the unique control concept of the UTRC Composite Bearingless Wind Turbine which utilizes a hub-mounted pendulum employed to twist the graphite composite inboard region of the blade producing blade pitch variations. The tests also demonstrated the predicted performance of 9 kW at 20 mi/h?(9 m/s) and the high-speed-stall control feature. 5 refs.

20 ELECTRIC POWER ENGINEERING

2001 Power Plants And Power Generation

REFER ALSO TO CITATION(S) 27968, 28095, 28096

27943 **(DOE/NASA/2593—24) [Technology Data Base for utility gas turbines for burning coal-derived fuels].** Clark, J.S.; Hodge, P.E.; Lowell, C.E.; Anderson, D.N.; Schulta, D.F. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). Mar 1981. Contract AI01-77ET10350. 49p. (NASA-TM—81708). NTIS, PC A03/MF A01. Order Number DE82004664.

The technical progress made during FY 1979 to provide a critical-technology data base for utility gas-turbine systems capable of burning coal-derived fuels is summarized. Coal-derived fuels present two major problems to utility gas turbines. First, they are typically high in organcally bound nitrogen, which is converted in the combustion process to oxides of nitrogen (NO/sub x/). Second, they contain trace-metal contaminants that can lead to hot corrosion and/or fouling in turbine hot sections. A combustion task is under way to address the first problem. A literature survey of coal-derived fuel properties was completed and a NO/sub x/ emission model was developed. A two-stage test rig was designed and tests were run to study the conversion of fuel-bound nitrogen to NO/sub x/. Catalytic combustion tests were also initiated to evaluate the feasibility of using heavy in catalytic combustors. To address the second problem, a statistially designed series of hot-corrosion burner rig tests were coducted to measure the corrosion rates of typical gas-turbine alloys with several fuel contaminants. The resultant data have been correlated into a hot-corrosion-life prediction model. This model was extended to longer times in 1979. Another approach to solving the hot-corrosion problem is to use a fuel additive that inhibits hot corrosion. Barium and strontium were identified as being particularly beneficial fuel additives. Still another approach to preventing hot corrosion is to protect the hot components with a coating. Ceramic thermal-barrier coatings offer potential corrosion resistance as well as thermal protection. Several advanced thermal-barrier coatings have demonstrated promising hot-corrosion resistance. Coating life was found to be a strong function of coating thickness.

27944 **(PB—81-803678) Boiler corrosion. 1964-October 1980 (citations from the NTIS Data Base). Report for 1964-Oct 1980.** (National Technical Information Service, Springfield, VA (USA)). Feb 1981. 177p. NTIS PC N01/MF N01.

Federally-funded research on design, efficiency, materials, cathodic protection, corrosion inhibiting additives, and combustion in coal and fuel oil fired boilers is cited. Studies on limestone injection for pollution control and its effect on boiler corrosion are included. The research also covers boilers in magnetohydrodynamic power generation, ships, and nuclear power plants. (This updated bibliography contains 172 citations, 11 of which are new entries to the previous edition.)

27945 **(PB—81-803686) Boiler corrosion. 1977-September 1979 (citations from the Engineering Index Data Base). Report for 1977-Sep 1979.** (National Technical Information Service, Springfield, VA (USA)). Feb 1981. 306p. NTIS PC N01/MF N01.

Worldwide research on materials, fuel types, fuel impurities, additives, efficiency, inhibitory, and combustion is cited. Boiler corrosion studies related to pollution control, feedwater treatment, testing, and boiler design are also included. (This updated bibliography contains 301 abstracts, none of which are new entries to the previous edition.).

27946 **(PB—81-803694) Boiler corrosion. October 1979-January 1981 (citations from the Engineering Index Data Base). Report for Oct 1979-Jan 1981.** (National Technical Information Service, Springfield, VA (USA)). Feb 1981. 158p. NTIS PC N01/MF N01.

Worldwide research on materials, fuel types, fuel impurities, additives, efficiency, inhibitors, and combustion is cited. Boiler corrosion studies related to pollution control, feedwater treatment, testing, and boiler design are also included. (This updated bibliography contains 153 citations, All of which are new entries to the previous edition.)

27947 **Reliability assessment of advanced coal-fired power systems.** Larson, J.W. (Mitre Corp, McLean, Va). *American Society of Mechanical Engineers, [Paper];* No. 81-JPGC-GT-1, 1-11(1981).

Results of a reliability assessment of several advanced electric power systems concepts are compared. These concepts include conventional steam systems without and with flue-gas-desulfurization, two fluidized bed systems (AFB and PFB), and two gasification combined-cycle systems (entrained-flow gasifier and slagging-bed gasifier). Gas turbines are employed in both the pressurized fluidized bed (PFB) and combined-cycle systems. 9 refs.

27948 **Hot gas cleanup program for pressurized fluidized bed combustor combined cycle power generation.** Perlsweig, M.; Neal, J.W.; Moore, W.E. (US DOE, Washington, DC). *American Society of Mechanical Engineers, [Paper];* No. 81-JPGC-GT-5, 1-10(1981).

Results from recent subpilot scale tests of pressurized fluidized combustors with turbine cascades and a small industrial gas turbine are reviewed. A program to evaluate and develop advanced hot gas cleanup concepts with the potential to resolve this problem has been initiated and a wide variety of approaches is being pursued.

27949 **Heat transfer to cooling coils in the "splash" zone of a pressurised fluirized bed combustor.** Byam, J.; Pillai, K.K.; Roberts, A.G. (US DOE, USA). *AIChE (American Institute of Chemical Engineers) Symposium Series;* 77: 351-358(1981).

Heat transfer coefficients have been measured in a fluidized bed combustor operating at 6 atm pressure and with a heat input of 2.8 MW. The cooling surface formed part of a tube bank 6.7 ft deep. Heat transfer in the splash zone and in the freeboard was investigated by varying the bed height between 4 and 9 ft. The work demonstrated the feasibility of changing load on a combined-cycle PFBC plant by varying the bed height during operation. 5 refs.

2002 Environmental Aspects

REFER ALSO TO CITATION(S) 27642, 27948, 28097, 28459, 28473, 28547, 28694, 28728

27950 (EPRI-CS—2238, pp 1.1-1.29) **Operating history and current status of fabric filters in the utility industry.** Piulle, W. (Electric Power Research Inst., Palo Alto, CA); Carr, R.; Goldbrunner, P. Feb 1982. NTIS, PC A21/MF A01.

From 1. conference on fabric filter technology for coal-fired power plants; Denver, CO, USA (15 Jul 1981).

A tabulation is presented of fabric filter installations currently operating or in the design/construction phase for coal-fired utility boilers. Information presented includes boiler and baghouse general design features, coal analysis, bag design, ash removal system, pressure drop and collection efficiency operating data, and response to a survey soliciting operating and maintenance data. Results show that as of June 1981, 72 fabric filters were in operation on utility boilers equivalent to 6700 MW generating capacity. Another 39 units equivalent to 10,700 MW are on order or under construction. Baghouse sizes now range from 6 MW to two 800 MW units currently under construction. Preliminary results from reporting utilities indicate bag lives in excess of two years, with several units exceeding 3 years. In addition, no boiler outages have been chargeable to failure of the fabric filter system.

27951 (EPRI-CS—2238, pp 2.1-2.13) **Manufacture of glas-fiber yarns.** Bolen, G.N. (Owens-Corning Fiberglass Corp., Toledo, OH). Feb 1982. NTIS, PC A21/MF A01.

From 1. conference on fabric filter technology for coal-fired power plants; Denver, CO, USA (15 Jul 1981).

A glass fiber, like all glass, is perceived more as a state of matter than a particular substance. The glass-like or vitreous state is that of a solid with the molecular structure of a liquid. Man has used glass fibers since antiquity. Modern man has perfected the glass-fiber manufacturing process in which molten glass is drawn through tiny orifices into hairlike filaments, coated with protective sizing as it hardens, and wound onto packages for processing. Glass fibers are now used in a number of applications, including filtration fabrics. Today, glass is the fiber of choice in many fabric filters, particularly those used by industries and utilities that generate electric power using low-sulphur coals. Glass-fiber can withstand continuous flue gas temperatures of 500°F and maintain good resistance to acids. Glass-fiber yarns that compose filtration fabrics are specified by a nomenclature system identifying yarn properties, diameter, thickness, and even the direction the yarn is twisted. Yarns are chosen by the weaver to form fabrics that provide characteristics necessary to perform in the baghouse environment.

27952 (EPRI-CS—2238, pp 2.15-2.30) **Manufacture and quality assurance testing of fiberglass filter fabrics.** Boudreau, R.J.; Hoffman, W.; McCluskey, S.C. (Burlington Glass Fabrics Co., Rockleigh, NJ). Feb 1982. NTIS, PC A21/MF A01.

From 1. conference on fabric filter technology for coal-fired power plants; Denver, CO, USA (15 Jul 1981).

Fiberglass filtration fabrics are woven with multifilament fiberglass yarns. The weaving process involves many steps. Preparation for weaving includes throwing, warping, slashing, and entering. After the fabric is woven, it is heat-cleaned and finished. Before a fabric and finish is approved for production, it is thoroughly evaluated as to its MIT flex endurance in both thermal and acid environments. All production fabrics and finishes undergo a complete battery of quality assurance tests before shipment.

27953 (EPRI-CS—2238, pp 2.31-2.43) **Finishing fiberglass filtration fabrics.** Grubb, W.T. (Wheelabrator-Frye Inc., Coraopolis, PA). Feb 1982. NTIS, PC A21/MF A01.

From 1. conference on fabric filter technology for coal-fired power plants; Denver, CO, USA (15 Jul 1981).

The service life of glass fabric filter bags in coal-fired boiler baghouses has yet to be clearly correlated with the fabric finish composition or finishing techniques. Of the factors contributing to baglife; the intrinsic properties of glass fibers, yarn processing and fabric weaving, finishing, bag fabrication and installation, baghouse design, and baghouse operation and maintenance; finishing may not be the most important, but it is certainly not the least important. The state-of-the-art of fiberglass filtration fabric finishing is examined, and some insight into the difficulties encountered in specifying and evaluating finishes for coal-fired boiler bags is provided.

27954 (EPRI-CS—2238, pp 2.45-2.81) **Specification and fabrication of filter bags.** Woolley, W.G. (Ecolaire, Inc., Malvern, PA). Feb 1982. NTIS, PC A21/MF A01.

From 1. conference on fabric filter technology for coal-fired power plants; Denver, CO, USA (15 Jul 1981).

The specification of the fabric, the finish and the construction of fabric filter bags is discussed. A typical specification of the construction of the bag and also a fabric specification are presented. Some in-plant photographs picturing the various steps in the manufacture of the filter bag and the quality control procedures are presented.

27955 (EPRI-CS—2238, pp 2.83-2.98) **Filter bag testing and evaluation.** Budrow, W.F. (Environmental Consultant Co., Phoenix, AZ). Feb 1982. NTIS, PC A21/MF A01.

From 1. conference on fabric filter technology for coal-fired power plants; Denver, CO, USA (15 Jul 1981).

The fabric filter in a baghouse must perform satisfactorily as a filter, be cleanable and be durable. The durability aspect of fiberglass filter bags is discussed with information on the chemical and physical characteristics of glass fibers, the weaving and production of fabric filters, and the testing of filters over a year's time to determine changes in the physical characteristics of the fibers, causes of fiber damage and the positions of fiber damage. Life projections for fabric filters ranged from 24 to 36 months. (LCL)

27956 (EPRI-CS—2238, pp 2.99-2.110) **New look at bag tensioning.** Leunig, C.V. (Albany International, NY). Feb 1982. NTIS, PC A21/MF A01.

From 1. conference on fabric filter technology for coal-fired power plants; Denver, CO, USA (15 Jul 1981).

The tension of the fabric bag in a power plant baghouse substantially affects the service life and performance of the filter bag. This tension, in turn, varies with the dimensional accuracy of the bag as delivered from the manufacturer, with the relative thermal expansion and creep characteristics of the metal baghouse as compared with the fiberglass filter, with the amount of weight accumulated on the filter surface, and with the spring-loading used to install the filter, and other factors. A device, consisting of an aircraft type stainless steel cable wound on the periphery of a cam which acts against a double coil spring, which is claimed to provide uniform accurate tensioning of the bag and which will, therefore, reduce baghouse maintenance and increase filter operating efficiency is described. (LCL)

27957 (EPRI-CS—2238, pp 2.111-2.134) **High temperature synthetic fiber filters for coal-fired boilers.** Muscelli, L.W.; Crippen, L.K. (E.I. Dupont de Nemours and Co., Inc., Wilimington, DE). Feb 1982. NTIS, PC A21/MF A01.

From 1. conference on fabric filter technology for coal-fired power plants; Denver, CO, USA (15 Jul 1981).

Three high temperature fibers are being produced commercially for high temperature filtration applications: fiberglass, Teflon TFE-fluorocarbon fiber and Nomex aramid fiber. Two experimental fibers, PBI polybenzimidazole and Ryton polyphenylene sulfide fibers are also candidates for this application. The properties of the commercially produced fibers are presented and discussed. Nomex

fiber provides users of dust filtration equipment with tough, abrasion resistant fabrics which can be used at high temperatures (400°F to 204°C) without loss of properties over extended periods of time. In certain gaseous environments at high temperatures Nomex can be chemically degraded. Hydrolytic degradation occurs at a rate dependent upon temperature, moisture level and acidic components of the gas stream. Alkaline particulate has the effect of minimizing acid attack through absorption of the sulfur oxides in the gas stream. The application of acid resistant finishes by the manufacturer of fabric or felt of Nomex have reportedly shown a 3-8X improvement in life in selected applications. Tests are being conducted by Du Pont to assess the improvement gained over untreated fabric. Teflon fiber is used extensively in highly corrosive environments and in high temperature environment up to 500°F (260°C).

27958 (EPRI-CS—2238, pp 3.1-3.34) **Development of guidelines for optimum baghouse fluid dynamic system design.** Eskinazi, D. (Dynatech R/D Co., Cambridge, MA); Gilbert, G.B.; Carr, R.C. Feb 1982. NTIS, PC A21/MF A01.

From 1. conference on fabric filter technology for coal-fired power plants; Denver, CO, USA (15 Jul 1981).

In recent years, the utility industry has turned to fabric filters as an alternative technology to electrostatic precipitators for particulate emission control from pulverized coal-fired power plants. One aspect of baghouse technology which appears to be of major importance in minimizing the size, cost, and operating pressure drop is the development of ductwork and compartment designs which achieve uniform gas and dust flow distribution to individual compartments and bags within a compartment. The objective of this project was to perform an experimental modeling program to develop design guidelines for optimizing the fluid mechanic performance of baghouses. Tasks included formulation of the appropriate modeling techniques for analysis of the flow of dust-laden gas through the collector system and extensive experimental analysis of fabric filter duct system design. A matrix of geometric configurations and operating conditions was experimentally investigated to establish the characteristics of an optimum system, to identify the level of fluid mechanic sophistication in current designs, and to experimentally develop new ideas and improved designs. Experimental results indicate that the design of the inlet and outlet manifolds, hopper entrance, hopper region below the tubesheet, and the compartment outlet have not been given sufficient attention. Unsteady flow patterns, poor velocity profiles, recirculation zones, and excessive pressure losses may be associated with these regions. It is evident from the results presented here that the fluid mechanic design of fabric filter systems can be improved significantly.

27959 (EPRI-CS—2238, pp 3.35-3.54) **Industrial fabric filter experience applicable to utilities.** Perkins, R.P. (E.I. Du Pont de Nemours & Co., Inc., Wilmington, DE). Feb 1982. NTIS, PC A21/MF A01.

From 1. conference on fabric filter technology for coal-fired power plants; Denver, CO, USA (15 Jul 1981).

A brief history is presented of the use of fabric filters for industrial coal-fired boilers and for coal-fired power plants, and of the development of design materials selection, and operating procedures which have contributed to the successful applications of these filters for both industry and electric utilities. (LCL)

27960 (EPRI-CS—2238, pp 3.55-3.88) **Test results from operating fabric filters: full scale and Arapahoe 10 MW pilot plant.** Carr, R.C. (Electric Power Research Inst., Palo Alto, CA); Smith, W.B.; Cushing, K.M. Feb 1982. NTIS, PC A21/MF A01.

From 1. conference on fabric filter technology for coal-fired power plants; Denver, CO, USA (15 Jul 1981).

The Electric Power Research Institute (EPRI) is currently supporting a major research program to optimize the performance of fabric filter baghouses in coal fired utility boiler applications. This program consists of extensive pilot plant research conducted at the Arapahoe Test Facility in Denver, Colorado, coupled with supporting evaluations of commercial utility baghouses. Reported here are operating characteristics of the 25 MW Kramer Station baghouse of Nebraska Public Power District and preliminary data from the EPRI 10 MW Fabric Filter Pilot Plant (FFPP) at Arapahoe. Results from Kramer show that the baghouse cleaning cycle had the greatest effect on particulate matter removal efficiency compared to any other operational parameters. Implementation of a preferred 100-minute cleaning cycle, obtained by extending the dwell time between compartment cleaning from zero to eight minutes, reduced particulate matter penetration by 50% without an increase in pressure drop. Total particulate matter collection efficiency measured for the baghouse with the preferred cycle in effect averaged 99.92%, with associated outlet emissions and stack opacity of 0.001 lb/10^6 Btu (0.43 ng/j) and 0.7%, respectively. The 0.07% opacity is equivalent to a 20 kilometer stack visibility. Preliminary results from the Arapahoe FFPP show that the lowest pressure drop (ΔP) was experienced with shake/deflate cleaning. Extended dwell times resulted in lower ΔP for compartments with reverse gas cleaning.

27961 (EPRI-CS—2238, pp 3.89-3.111) **Measurement procedures and supporting research for fabric filters.** Smith, W.B. (Southern Research Inst., Birmingham, AL); Cushing, K.M.; Carr, R.C. Feb 1982. NTIS, PC A21/MF A01.

From 1. conference on fabric filter technology for coal-fired power plants; Denver, CO, USA (15 Jul 1981).

The performance of EPRI's 10 MW Fabric Filter Pilot Plant (FFPP) is being characterized by detailed measurements of the properties of the aerosol particles and dust cake. Several methods are being used to measure the size and concentration of the aerosol particles. The overall efficiency of the compartment cleaned by reverse air is 99.992%. The efficiency of the compartment cleaned by deflate and shaking is 99.973%. A minimum in the fractional efficiency occurs at about 8 μm particle diameter. The residual dust cakes are rather thick on the compartments cleaned by reverse air and contain many large nodules clinging to protruding fibers. The cake on the bags cleaned by deflate and shaking are thinner with no nodules. Scanning electron microscopy of the fractional nodules an smooth cake has been performed to investigate the nature of the structure. No systematic differences were found between the two types of cakes. In particular, no concentration of fine particles nor cementitious material was found in either case.

27962 (EPRI-CS—2238, pp 3.113-3.123) **Arizona Public Service Company Four Corners pilot plant experience.** Singh, U.K. (Arizona Public Service Co., Phoenix, AZ); Vaklyes, J.W. Jr.; Osborn, D.A. Feb 1982. NTIS, PC A21/MF A01.

From 1. conference on fabric filter technology for coal-fired power plants; Denver, CO, USA (15 Jul 1981).

The Four Corners Steam Generating Plant in New Mexico had a two module baghouse which, on successive startups, experienced increasing pressure drops across the filter. The investigation of the cause of this costly problem and the solution to the problem affected by purging the filter buildup in a specific direction are described. (LCL)

27963 (EPRI-CS—2238, pp 4.1-4.51) **Australian experience with fabric filters on power boilers.** Floyd, G.J. (Electricity Commission of New South Wales, Sydney, Australia); Vandewalle, A.T.M. Feb 1982. NTIS, PC A21/MF A01.

From 1. conference on fabric filter technology for coal-fired power plants; Denver, CO, USA (15 Jul 1981).

Experience with fabric filters on power boilers owned and operated by the Electricity Commission of New South Wales is discussed. The pioneering work carried out at Tallawarra and Wangi power stations and the results which paved the way for the use of fabric filters for new base load plant are reviewed. Factors influencing the selection of fabric filters for 4 x 660 MW boilers at Erarring power station are discussed as are relevant details of specification, design, research and development, contract execution and maintenance philosophy. ECNSW's commitments in the future on a six fabric filter plants; four for Bayswater power station (4 x 660 MW) and two for Mount Piper power station (2 x 660 MW), are described.

27964 (EPRI-CS—2238, pp 4.53-4.80) **Demonstration of SO_2 removal on a 22 MW coal-fired utility boiler by dry injection of nahcolite.** Muzio, L.J. (KVB, Inc., Irvine, CA); Sonnichsen, T.W.; Brines, H.G.; Albrandt, A.B.; Hooper, R.; Shah, N.D. Feb 1982. NTIS, PC A21/MF A01.

From 1. conference on fabric filter technology for coal-fired power plants; Denver, CO, USA (15 Jul 1981).

A full-scale demonstration of the dry removal of SO_2 with nahcolite (naturally occurring sodium bicarbonate) was conducted at Public Service Company of Colorado's Cameo Unit No. 1. This is a 22 MW coal-fired boiler retrofitted with a fabric filter. In the dry SO_2 removal process nahcolite is pulverized and injected into the flue gas stream ahead of the fabric filter and downstream of the air preheater. The nahcolite collects on the bags and the SO_2 is removed as the flue gas passes through the filter cake. The objectives of the program were (1) to demonstrate the level of SO_2 removal attainable on a full-scale utility system under typical operating conditions, and (2) to assess the impact of nahcolite injection on the operation of the fabric filter. The test program demonstrated SO_2 removals of 75 to 83% with the injection of a stoichiometric amount of nahcolite into the flue gas. The rate of reaction between nahcolite and SO_2 was decreased when baghouse temperature was reduced from 300°F to 275°F. This effect lessened the average SO_2 removal to nearly 40% when injecting near stoichiometric amounts. In addition to SO_2 removal, the dry injection of nahcolite also resulted in a simultaneous removal of nitric oxide on the order of 8% to 14%. Nahcolite injection had no substantial impact on the fabric filter operation. The rate of change in flange-to-flange pressure drop during filtration increased by about 20% due to nahcolite injection.

27965 (EPRI-CS—2238, pp 4.81-4.97) **Spray dryer status: commercial installations and EPRI pilot plant.** Dalton, S.M.; Rhudy, R.G. (Electric Power Research Inst., Palo Alto, CA). Feb 1982. NTIS, PC A21/MF A01.

From 1. conference on fabric filter technology for coal-fired power plants; Denver, CO, USA (15 Jul 1981).

Spray drying is a new flue gas desulfurization technique with fast growing utility acceptance. Over 8000 MW will be committed by year end. All but one installation already planned will be followed by a fabric filter. The designs and costs for these initial installations and EPRI's spray dryer pilot plant which is now under construction are discussed. The pilot plant will test the effect on SO_2 removal and operation of variables such as atomizer type, reagent ratio, reagent preparation, type of reagent, vessel residence time, gas inlet temperature, approach to saturation, and effect of recycle.

27966 (EPRI-CS—2238, pp 4.99-4.123) **Baghouses for high sulfur coal applications.** Gehri, R.P. (Southern Company Services, Inc., Birmingham, AL). Feb 1982. NTIS, PC A21/MF A01.

From 1. conference on fabric filter technology for coal-fired power plants; Denver, CO, USA (15 Jul 1981).

Because of increasingly stringent particulate control standards, it is imperative that the electric utility industry investigate the use of baghouse applied to boilers firing high sulfur coal as well as boilers firing low sulfur coal. EPRI is conducting a 10 MW pilot scale investigation of a baghouse applied to a high sulfur coal boiler. The Southern Company is co-funding this project and Gulf Power Company is acting as the host utility. The project objectives, the facility description, design information, and the project schedule are discussed.

27967 (EPRI-CS—2238, pp 4.125-4.154) **Current status and future potential for high-ratio fabric filter technology applied to utility coal-fired boilers.** Lanois, G.D. (Flakt, Inc., Old Greenwich, CT); Wiktorsson, A. Feb 1982. NTIS, PC A21/MF A01.

From 1. conference on fabric filter technology for coal-fired power plants; Denver, CO, USA (15 Jul 1981).

With increasing frequency since the early 1970s, fabric filters have been applied to coal-fired boilers for particulate control. Generally, low-ratio fabric filter technology has shown acceptable operating results for coal-fired boilers. However, in recent years, high-ratio technology has emerged as an alternative, competitive technology. This paper discusses traditional and advanced high-ratio designs currently applied to utility coal-fired boilers. There is also a comparison of high-ratio vs. low-ratio technology and included are illustrations and charts dealing with both technologies. In view of the current status of the high-ratio technology, a discussion of future development potential is discussed and a positive projection of the future utilization for high-ratio fabric filter technology is forecast.

27968 **Polychlorinated biphenyls in effluents from combustion of coal/refuse.** Richard, J.J.; Junk, G.A. (US DOE, Ames, Iowa, USA). *Environmental Science and Technology;* **15**: No. 9, 1095-1100(Sep 1981).

The effluents studied were grate ash, fly ash, stack ash, stack gas, sluice water, and sluice sediment. The polychlorinated biphenyls content of the coal and refuse-derived fuel fuels and the air used to support the combustion were also measured. 24 refs.

2003 Power Transmission And Distribution

REFER ALSO TO CITATION(S) 28095

27969 **(PB—81-156606) Helium research in support, of superconducting power transmission. Annual report, 1 Oct 1978-30 Sep 1979.** Daney D.E. (National Bureau of Standards, Boulder, CO (USA)). Dec 1980. 59p. NTIS, PC A04/MF A01.

The authors have completed the first phase of our investigation of SPTL cool-down in which the aim was to develop a fundamental understanding of the counter-flow method of cool-down. The excellent agreement of our analytical, numerical, and experimental results gives us confidence that we can accurately model the cool-down of full scale SPTL's. The cable permeability measurements indicate that any significant rupture of the lead gas barrier of the cable will lead to an unacceptably high leak rate from the pressurized core.

27970 **Planning available capacity in electrical power generation.** Maybee, J.S.; Randolph, P.H.; Uri, N.D. (Univ of Colo, Boulder, USA). *Applied Energy;* **9**: No. 1, 23-31(Sep 1981).

In planning for the utilization of available capacity, an electrical company needs to know the power requirements of the system. THe load versus duration curve provides information on past demand patterns and thus forms a basis for planning future supply needs. Since electrical supply is discrete by nature, the load versus duration curve only approximates to the true supply requirements. This paper develops an algorithm for finding an optimal step function approximation to the load versus duration curve. It is based on the minimization of a total penalty function. 10 refs.

21 NUCLEAR POWER PLANTS

REFER ALSO TO CITATION(S) 27708

27971 **(FRAMATOME-R—4) List of the nuclear power plants in the world.** Bebin, J. (Societe Franco-Americaine de Constructions Atomiques (FRAMATOME), 92 - Courbevoie (France)). Dec 1980. 54p. (In French). NTIS (US Sales Only), PC A04/MF A01. Order Number DE81700317.

The world list of nuclear power stations concerns all the units definitely ordered, whether in operation, definitely shut down, in any stage of construction or even put back to an indefinite date. Cancelled power stations are mentioned, save those cancelled during the present year. Shut down power stations are included in power stations ordered but are deducted as from the date of closure. The complex of power stations is divided into two lists: List A (classified by name of builder) and List B (classified by country).

27972 (OTA-ISC—153, pp 109-144) **Soviet nuclear power industry.** Nov 1981. NTIS, PC A18/MF A01.

In Technology & soviet energy availability.

This chapter summarizes Soviet policy toward nuclear power, describes the present state of the Soviet nuclear power industry, and evaluates Soviet planners' goals for the contribution of nuclear-generated electricity to the energy balance in 1985 and 1990. It also examines the past and potential contribution of Western equipment and technology to that industry.

27973 **Role of nuclear energy in the less developed countries.** Connolly, T.J. pp 84-88 of Energy and the developing nations. Auer, P. (ed.). Elmsford, NY; Pergamon Press Incorporated (1981).

From Electric Power Research Institute workshop on energy and the developing nations; Stanford, CA, USA (19 Mar 1980).

The projections presented in this report for the deployment of nuclear electric capacity in various countries were derived from a study of world nuclear energy futures. The work was performed at the German Nuclear Research Center at Julich. The analysis was done for the world community as a whole, with no specific emphasis on developing countries.

27974 **Criteria for nuclear electricity generation in developing countries.** Roth, E.B. pp 89-97 of Energy and the developing nations. Auer, P. (ed.). Elmsford, NY; Pergamon Press Incorporated (1981).

From Electric Power Research Institute workshop on energy and the developing nations; Stanford, CA, USA (19 Mar 1980).

Four factors which are analyzed in establishing the criteria for developing nuclear power are alternate sources of energy, reactor sizes and grid capacities, financing capabilities, and technological development.

2101 Power Reactors, Non-breeding, Light-water Moderated, Boiling Water Cooled

REFER ALSO TO CITATION(S) 28009, 28039, 28040, 28042, 28043, 28044, 28048

27975 **(EPRI-NSAC—6) Workshop on data-acquisition and -display systems: directions after TMI.** (Technology for Energy Corp., Knoxville, TN (USA)). Nov 1980. 89p. NTIS, PC A05/MF A01. Order Number DE82901378.

The accident at Three Mile Island Unit-2 raised questions as to the adequacy of data acquisition and display systems in commercial nuclear power plants. A series of recommendations have developed from the various groups that have analyzed the accident in order to improve the oprator's overview of the plant safety conditions and to facilitate information transfer to technical support centers in emergency situations. This report is the result of an NSAC-sponsored workshop, where the various recommendations and emerging regulatory requirements were reviewed in an attempt to provide an integrated basis for their implementation.

27976 **(HEDL-SA—2546) Surveillance dosimetry of operating power plants.** McElroy, W.N.; Davis, A.I.; Gold, R. (Hanford Engineering Development Lab., Richland, WA (USA)). 16 Oct 1981. Contract AC06-76FF02170. 42p. (CONF-811042—18). NTIS, PC A03/MF A01. Order Number DE82003795.

From 9. water reactor safety research information meeting; Washington, DC, USA (26 Oct 1981).

The main focus of the research efforts presently underway is the LWR power reactor surveillance program in which metallurgical test specimens of the reactor PV and dosimetry sensors are placed in three or more surveillance capsules at or near the reactor PV inner wall. They are then irradiated in a temperature and neutron flux-spectrum environment as similar as possible to the PV itself for periods of about 1.5 to 15 effective full-power years (EFPY), with removal of the last capsule at a fluence corresponding to the 30- to 40-year plant end-of-life (EOL) fluence. Because the neutron flux level at the surveillance position is greater than at the vessel, the test is accelerated wit respect to the vessel exposure, allowing early assessment of EOL conditions.

27977 **Computational model of backlay welding for controlling residual stresses in welded pipes.** Brust, F.W.; Rybicki, E.F. (Battelle, Columbus Lab, Ohio, USA). *Journal of Pressure Vessel Technology;* **103**: No. 3, 226-232(Aug 1981).

Intergranular Stress Corrosion Cracking (IGSCC) has been a problem in Boiling Water Reactor (BWR) piping systems. This paper describes a computational model and its use in examining the effectiveness of the backlay welding process. The model has demonstrated an ability to predict weld-induced residual stresses for a variety of pipe sizes and welding conditions. Computational results for backlay welding are in agreement with residual stress data. 22 refs.

27978 **Experimental study of striping at the interface of thermal stratification.** Fujimoto, T.; Sawada, K.; Uragami, K.; Tsuge, A.; Hanzawa, K. (Mitsubishi Heavy Ind Ltd, Jpn). *Journal of Heat Transfer;* **15**: 73-78(1981). (CONF-810804—).

From 20. national heat transfer conference; Milwaukee, WI, USA (2 Aug 1981).

Striping phenomena at the interface of thermal stratification is applied to integrity of components and piping of LWR and FBR. An experimental study was conducted to investigate the thermal behavior of density interface. This test result suggests that it is too conservative to use the temperature fluctuation at the stratified interface along the centerline of the pipe for the realistic structural evaluation. 7 refs.

27979 **Effects of induction heating parameters on controlling residual stress in intermediate size pipes.** Rybicki, E.F.; McGuire, P.A. (Univ of Tulsa, Okla). *American Society of Mechanical Engineers, [Paper];* No. 81-PVP-31, 1-12(1981).

Induction heating for stress improvement (IHSI) is a method for reducing the tensile weld induced stresses on the inner surfaces of the girth welded pipes. The process entails inductively heating the outside of a welded pipe while cooling the inner surface with flowing water. A 10-inch schedule 80 Type 304 stainless steel pipe was selected for this study. Residual stresses due to welding were first determined using a finite element computational model. 26 refs.

27980 **Numerical calculation of the global and local components of the neutron noise field in boiling water reactors.** Difilippo, F.C.; Otaduy, P.J. (Oak Ridge Natl Lab, Tenn, USA). *Nuclear Science and Engineering;* **75**: No. 3, 258-264(Sep 1980).

A numerical model of the neutron noise field in boiling water reactors (BWRs), which can be readily implemented in existing deterministic computer codes, was formulated. The basis of the model is the assumption of separability of the noise field into local and global components. The application of this modeling was twofold: to determine the frequency range above which cross-correlation techniques can be used to measure steam velocities under normal operating conditions and to evaluate the validity of the point kinetics description of the global component of the neutron noise in BWRs. This paper describes a method for the calculation of the ratio of the local to the global components of the neutron noise field. 17 refs.

2102 Power Reactors, Non-breeding, Light-water Moderated, Non-boiling Water Cooled

REFER ALSO TO CITATION(S) 27975, 27976, 27978, 28009, 28028, 28032, 28033, 28036, 28039, 28041, 28042, 28043, 28045, 28046, 28047, 28048

27981 **(EPRI-NP—2046-Vol.1) Single-tube thermal and hydraulic tube support test. Final report.** Curlee, N.J. Jr.; Baum, A.J. (Westinghouse Electric Corp., Forest Hills, PA (USA). Nuclear Technology Div.). Sep 1981. 71p. NTIS, PC A04/MF A01. Order Number DE82900886.

The work described in this report (volumes 1 and 2) was an experimental project to measure the inception and extent of dryout or liquid deficient heat transfer and chemical precipitation in presently used steam generator tube-tube support geometries and modified geometries. Since chemical precipitation or concentration may lead to corrosion this program was planned to find the dependence of dryout and chemical precipitation on geometry, heat flux and fluid conditions. It was found that dryout depended principally on tube support geometry and heat flux. There was little dependence on flow rate, quality and pressure. It was found that certain tube support geometries could produce local dryout which in turn could permit significant chemical concentration. Chemical concentration was not found in tube support geometries not exhibiting dryout.

The interrelationship between the heat and mass transfer processes in the crevices was further demonstrated by comparing the results of an analytic model for predicting the shape of the liquid vapor interface to the outline of a precipitate pattern resulting from chemical concentration.

27982 **(GEND—014) Examination results of the Three Mile Island radiation detector HP-R-211.** Murphy, M.B.; Mueller, G.M.; Thome, F.V. (Sandia National Labs., Albuquerque, NM (USA)). Oct 1981. Contract AC07-76ID01570. 132p. NTIS, PC A07/MF A01. Order Number DE82004023.

An area radiation detector, HP-R-211, which was removed from the Three Mile Island containment building on August 15, 1980, has been examined. The detector had failed at some time following the accident and indicated erroneous, low radiation levels from that point on. This report discusses the cause of failure, detector radiation measurement characteristics, our attempts to reconstruct the gamma rate history from detector output stripchart recordings, and our estimates of the total gamma radiation dose received by the detector electronics. We have also identified the radioactive contaminants present on the detector and explored decontamination methods.

27983 **Fatigue crack growth in pressurized water reactor feedwater lines.** Bamford, W.H.; Thurman, A.; Mahlab, M. (Wetinghouse Electr Corp, Pittsburgh, Pa). *American Society of Mechanical Engineers, [Paper];* No. 81-PVP-2, 1-13(1981).

In mid-1979 cracking was discovered in one of the feedwater lines of an operting PWR system. Further inspection of the other lines at this plant, as well as other plants, revealed other instances of cracking, and as a result an exhaustive investigation was undertaken. This paper will present a review of the investigation, with emphasis on the use of field measurements, flow model tests and metallurgical investigations to predict both the initiation and growth of these cracks. 12 refs.

27984 **Flow model test for the investigation of feedwater line cracking for pwr steam generators.** Hu, M.H.; Houtman, J.L.; White, D.H. (Westinghouse Electr Corp, Pittsburgh, Pa). *American Society of Mechanical Engineers, [Paper];* No. 81-PVP-4, 1-11(1981).

This paper presents results of the thermal and hydraulic flow model test that became a major part of the Feedwater Line Cracking investigation for PWR plants. It dealt with the evaluation of the thermal/hydraulic conditions at the feedwater pipe-to-steam generator nozzle entrance. Thermal stratification and striping were identified as the two principal conditions of concern. 7 refs.

2103 Power Reactors, Non-breeding, Graphite Moderated

REFER ALSO TO CITATION(S) 28004, 28006

27985 **(CONF-811141—2) Corrosion-induced microstructural changes in a US core graphite.** Eatherly, W.P.; Lee, D.A. (Oak Ridge National Lab., TN (USA)). 1981. Contract W-7405-ENG-26. 4p. NTIS, PC A02/MF A01. Order Number DE82003995.

From Colloquium on the transport of fission products in matrix and graphite; Berlin, F.R. Germany (9 Nov 1981).

The results reported here apply to Great Lakes grade H-451 graphite, the core graphite specified for the US HTGR. This graphite is structurally similar to the German reflector grades we have investigated at ORNL, and hence should be applicable to them if similar impurity levels are obtained. Moreover, these results extend and confirm the behavior pattern exhibited by the fuel matrix material A3-3 reported in the previous paper, although the effects are more pronounced in A3-3 presumably due to its resin-type binder and low heat-treatment temperatures.

27986 **Study on creep behavior evalustion for welded joint in high temperature structure design.** Satoh, K.; Toyoda, M.; Satoh, K. (Osaka Univ, Jpn). *American Society of Mechanical Engineers, [Paper];* No. 81-PVP-36, 1-5(1981).

In this paper, creep behavior of welded joints which are subjected to transverse and longitudinal loads respectively have been discussed from bimetallic view points. And, a selection method of suitable welding material for base metal to be employed has been discussed from views of joint efficiency and creep strain. 1 ref.

2104 Power Reactors, Non-breeding, Otherwise Moderated Or Unmoderated

REFER ALSO TO CITATION(S) 28016

2105 Power Reactors, Breeding

REFER ALSO TO CITATION(S) 27776, 27978, 27986, 28034, 28048

27987 **(DOE/SF/77011—T3) Thermal hydraulic evaluation of advanced wire-wrapped assemblies.** Wei, J.P. (General Electric Co., Sunnyvale, CA (USA). Fast Breeder Reactor Dept.). 31 Jul 1975. Contract AT03-76SF77011. 56p. NTIS, PC A04/MF A01. Order Number DE82004248.

The thermal-hydraulic analyses presented in this report are based on application of the subchannel concept in association with the use of bulk parameters for coolant velocity and coolant temperature within a subchannel. The interactions between subchannels are due to turbulent interchange, pressure-induced diversion crossflow, directed sweeping crossflow induced by the helical wire wrap, and transverse thermal conduction. The FULMIX-II computer program was successfully developed to perform the steady-state temperature predictions for LMFBR fuel assemblies with the reference straight-start design and the advanced wire-wrap designs. Predicted steady-state temperature profiles are presented for a typical CRBRP 217-rod wire-wrapped assembly with the selected wire-wrap designs.

27988 **(DOE/SF/78003—T6) General Electric contribution to the 1st reference clad and duct (RCD) program.** (General Electric Co., Sunnyvale, CA (USA). Advanced Reactor Systems Dept.). 1 Apr 1976. Contract AT03-76SF78003. 65p. NTIS, PC A04/MF A01. Order Number DE82004021.

In the design of LMFBR fuel channels bowing, stresses are induced primarily by swelling of the channel material. An important aspect in channel design is the ability (or inability) of irradiation creep to relieve these stresses. The deformation mode of interest is therefore bending which is essentially a combination of uniaxial tension and compression. The primary objective of the C-1 experiment is to evaluate irradiation creep in bending and determine whether the use of standard biaxial and uniaxial irradiation creep data for the prediction of creep in bending is valid. Secondary objectives are to investigate the effect of material anisotropy in the case of 20% CW 316, the dependence of irradiation creep on swelling, the effect of stress on the creep rate of CW 316 and indirectly measure the creep behavior for a material in compression.

27989 **(ENICO—1099) Correlation of ^{239}Pu thermal and fast reactor fission yields with neutron energy.** Maeck, W.J. (Exxon Nuclear Idaho Co., Inc., Idaho Falls (USA)). Oct 1981. Contract AC07-79ID01675. 84p. NTIS, PC A05/MF A01. Order Number DE82004507.

The relative isotopic abundances and the fisson yields for over 40 stable and long-lived fission products from ^{239}Pu fast fission were evaluated to determine if the data could be correlated with neutron energy. Only mass spectrometric data were used in this study. For some nuclides changes of only a few percent in the relative isotopic abundance or the fission yields over the energy range of thermal to 1 MeV are easily discernable and significant; for others the data are too sparse and scattered to obtain a good correlation. The neutron energy index usedin this study is the ^{150}Nd/^{143}Nd isotopic ratio. The results of this correlation study compared to the US Evaluated Nuclear Data File (ENDF) fast fission yield compilation. Several discrepancies are noted and suggestions for future work are presented.

27990 **(HEDL-SA—2387-FP) LMFBR fuel component costs.** Epperson, E.M.; Borisch, R.R.; Rice, L.H. (Hanford Engineering Development Lab., Richland, WA (USA)). 29 Oct 1981. Contract AC06-76FF02170. 12p. (CONF-811108—6). NTIS, PC A02/MF A01. Order Number DE82003799.

From Annual meeting of the Institute of Chemical Engineers; New Orleans, LA, USA (8 Nov 1981).

A significant portion of the cost of fabricating LMFBR fuels is in the non-fuel components such as fuel pin cladding, fuel assembly ducts and end fittings. The contribution of these to fuel fabrication costs, based on FFTF experience and extrapolated to large LMFBR fuel loadings, is discussed. The extrapolation considers the expected effects of LMFBR development programs in progress on non-fuel component costs.

27991 **(HEDL-SA—2397-FP) Breeder reactor fuel fabrication system development.** Bennett, D.W.; Fritz, R.L.; McLemore, D.R.; Yatabe, J.M. (Hanford Engineering Development Lab., Richland, WA (USA)). 16 Jul 1981. Contract AC06-76FF02170. 12p. (CONF-810941—6). NTIS, PC A02/MF A01. Order Number DE82003822.

From ANS technical base for nuclear fuel cycle policy; Newport, RI, USA (20 Sep 1981).

Significant progress has been made in the design and development of remotely operated breeder reactor fuel fabrication and support systems (e.g., analytical chemistry). These activities are focused by the Secure Automated Fabrication (SAF) Program sponsored by the Department of Energy to provide: a reliable supply of fuel pins to support US liquid metal cooled breeder reactors and at the same time demonstrate the fabrication of mixed uranium/plutonium fuel by remotely operated and automated methods.

27992 **(HEDL-SA—2417) USA/FBR program fast flux test facility startup physics and reactor characterization methods and results.** Bennett, R.A.; Harris, R.A.; Daughtry, J.W. (Hanford Engineering Development Lab., Richland, WA (USA)). Sep 1981. Contract AC06-76FF02170. 56p. (CONF-8109101—1). NTIS, PC A04/MF A01. Order Number DE82003816.

From International atomic energy agency seminar; Julich, F.R. Germany (14 Sep 1981).

Final confirmation of much of the engineering mockup work has been achieved in FTR zero-power experiments in February, 1980, and in power demonstration performed in December, 1980, and March, 1981. Final in-core low-power and high-power irradiation of spatially distributed radioactivants will be completed late in 1981. This paper describes physics experiments and present summaries of the extensive results accumulated to date. 53 figures.

27993 **(HEDL-SA—2419-FP) FFTF primary heat transport system heating, ventilating and air conditioning system experience.** Umek, A.M.; Hicks, D.F.; Schweiger, D.L. (Hanford Engineering Development Lab., Richland, WA (USA)). 1981. Contract AC06-76FF02170. 42p. (CONF-811103—52). NTIS, PC A03/MF A01. Order Number DE82003776.

From ANS winter meeting; San Francisco, CA, USA (29 Nov 1981).

FFTF cools its primary/in-containment sodium equipment cells by means of a forced nitrogen cooling system which exchanges heat with a water-glycol system. The nitrogen cooling system is also used to maintain an inert gas atmosphere in the cells containing sodium equipment. Sodium Piping and Components have installed electrical resistance heaters to maintain a minimum sodium temperature and stainless steel jacketed mineral insulation to reduce heat loss. Design features and test results of a comprehensive redesign of the HVAC and insulation system required to support long-term nuclear operations are discussed.

27994 **Simulation of fluid thermal fluctuations in the clinch river breeder reactor plant steam generator using model testing.** Garner, D.C.; Novendstern, E.H. (Westinghouse Electr Corp, Madison, Pa). *Journal of Heat Transfer;* **15**: 63-72(1981). (CONF-810804—).

From 20. national heat transfer conference; Milwaukee, WI, USA (2 Aug 1981).

Testing has been performed using two 1/6 scale models of the Clinch River Breeder Reactor Plant Steam Generators to simulate fluid temperature fluctuations in the sodium. Water was used as the working fluid and the models were fabricated from Plexiglas to facilitate flow visualization. Hydraulic scaling was achieved through Richardson Number and Euler Number similarity. 4 refs.

27995 **Three-dimensional Fast Flux Test Facility plenum model turbulent flow prediction and data comparison.** Eyler, L.L.; Sawdye, R.W. (Battelle, Pac Northwest Lab, Richland, Wash). *Journal of Heat Transfer;* **15**: 79-86(1981). (CONF-810804—).

From 20. national heat transfer conference; Milwaukee, WI, USA (2 Aug 1981).

Two- and three-dimensional numerical simulations of turbulent flow in a scaled Fast Flux Test Facility (FFTF) upper plenum model were performed using the TEMPEST hydrothermal code. A model was used to describe turbulence through an effective viscosity. Comparisons with previously reported mean velocity and turbulence field data measured in the plenum model and two-dimensional numerical simulations using the TEACH code were made. 7 refs.

27996 **FFTF core component duct lifetime: criteria and core management methods.** Hecht, S.L. (Westinghouse Electr Corp, Richland, Wash). *American Society of Mechanical Engineers, [Paper];* No. 81-PVP-23, 1-10(1981).

Core component duct lifetime criteria presently used for lifetime predictions at the Fast Flux Test Facility (FFTF) are presented. Rationale for these lifetime criteria, based on recent analysis and testing, is given. Core component duct lifetimes are based on limiting, to acceptable values, the permanent (inelastic) duct deformations caused by the unique environment of fast neutron flux and high temperature which are generic to Fast Breeder Reactor (FBR) cores. With current structural material, duct deformations are, in many cases, the critical life limiting mechanism of core components. A method for analytically "tracking" these critical deformations has been developed for FFTF operations, and is outlined. 4 refs.

27997 **Analysis of prestressed double-wall tubing for LMFBR steam generators.** Uber, C.F.; Langford, P.J. (Westinghouse Electr Corp, Tampa, Fla). *American Society of Mechanical Engineers, [Paper];* No. 81-PVP-25, 1-6(1981).

A radial interface pressure is provided between the inner and outer tubes of each double-wall tube in a steam generator design now being developed for commercial breeder reactor plants. This paper describes a finite element analysis of the manufacturing technique used to prestress the double-wall tube. The analytical predictions are compared with experimental measurements of the residual interface pressure. Resulting residual stress states are used as the starting point for operating condition analyses. 9 refs.

27998 **Special considerations of local structural discontinuities in thin-walled LMFBR piping.** Karabin, M.E.; Mello, R.M.; Hulbert, G.M. (Westinghouse Electr Corp, Madison, Pa). *Journal of Pressure Vessel Technology;* **50**: 67-81(1981). (CONF-810625—).

From ASME PVP conference; Denver, CO, USA (21 Jun 1981).

Thin-walled, large-diameter piping systems for liquid metal fast breeder reactor (LMFBR) plants are relatively flexible; however, local structural discontinuities in the piping affect the flexibility of a piping loop and the local stress patterns in its piping components. This paper describes some of the local structural discontinuities in the Clinch River Breeder Reactor Plant (CRBRP) large-diameter heat transport system piping and their effect on the piping. Branch connections are located in the CRBRP large-diameter piping to provide connections for drain and gas line small piping. These fittings can be located near elbow-straight pipe junctions. A three-dimensional analysis has been completed to determine applicability of branch connection indices and to assess the interaction of the branch connection insert weld and elbow. For the CRBRP piping the local flexibility of equipment nozzles can alter the flexibility of the piping loop. A simplified analysis of the reactor vessel

nozzle is completed using ASME Code formulas to predict local shell and nozzle flexibilities. 16 refs.

27999 **Validation study of COBRA-WC for LMFBR steady-state and transient analyses.** Khan, E.U.; Prather, W.A.; George, T.L.; Bates, J.M.; Cheatham, R.L. (Battelle, Pac Northwest Lab, Richland, Wash, USA). *AIChE (American Institute of Chemical Engineers) Symposium Series;* 77: 254-264(1981). (CONF-810804—).

From 20. national heat transfer conference; Milwaukee, WI, USA (2 Aug 1981).

The COBRA-WC computer program is being widely used to predict flow and temperature fields in LMFBR rod bundles. Since the code is being used to benchmark other simpler codes, a validation study has been conducted to reinforce its credibility. A set of generalized parameters was shown to predict data well for a wide range of geometries and operating conditions which extend from typical (of small size LMFBRs) fuel assembly to typical blanket assembly geometry and forced mixed and natural convection regimes. The data base used for validating COBRA-WC was obtained from out-of-pile and in-pile tests in wire-wrapped pin bundles in which the pins are arranged in a triangular array. 23 refs.

28000 **Temperature profiles in natural and forced circulation of sodium through a vertical LMFBR blanket test assembly.** Engel, F.C.; Markley, R.A.; Minushkin, B. (Westinghouse Electr Corp, Madison, Pa, USA). *AIChE (American Institute of Chemical Engineers) Symposium Series;* 77: 265-271(1981).

Pumped circulation tests had been performed over a wide range of high and low flows in an electrically-heated blanket assembly model. In order to compare temperature distributions obtained in pumped tests with those in natural circulation operation a series of steady state natural circulation tests was performed establishing approximately similar low flow rates by heat addition to the test section and heat removal in a bypass air blast cooler. Such a comparison is made in this study. To achieve the desired circulation rates, higher temperature rise levels had to be established than were typical for pumped circulation. For the same flow Reynolds Number the normalized temperature profiles obtained were flatter than those for pumped circulation over a wide range of heat input gradients (1:1 to 4.6:1 max/m,in). 8 refs.

28001 **Neutron importance and sensitivity coefficients in iteration synthesis methods.** Kuz'min, A.M.; Rafaev, K.S.; Khromov, V.V. *Soviet Atomic Energy (English Translation);* 48: No. 3, 172-176(Mar 1980).

Equations are formulated for the neutron importance, an iteration scheme is described for solving these equations, and the results of calculations of the sensitivity coefficients are given for a typical fast sodium reactor with oxide fuel. 8 refs.

2107 Regulation And Licensing

REFER ALSO TO CITATION(S) 28031

2108 Economics

28002 **(CONF-811144—1) Overview of the nuclear fuel cycle.** Leuze, R.E. (Oak Ridge National Lab., TN (USA)). 1981. Contract W-7405-ENG-26. 60p. NTIS, PC A04/MF A01. Order Number DE82004119.

From Applied health physics course; Oak Ridge, TN, USA (3 Nov 1981).

The use of nuclear reactors to provide electrical energy has shown considerable growth since the first nuclear plant started commercial operation in the mid 1950s. Although the main purpose of this paper is to review the fuel cycle capabilities in the United States, the introduction is a brief review of the types of nuclear reactors in use and the world-wide nuclear capacity.

28003 **1979 outage experience of nuclear electric-power generating plants.** Scott, R.L. *Nuclear Safety;* 22: No. 3, 372-386(May 1981).

This article summarizes the 1979 outage experience of 67 licensed nuclear power plants. Operating statistics and data are presented for each plant that was in commercial operation at the end of the year and had sufficient electrical generation for meaningful analyses. The one exception is Three Mile Island 2; operational data for this unit covers only the period January 1 through July 19, 1979. Included in this article are the data for 25 BWR plants; 41 PWR plants; and Fort St. Vrain. During 1979 the 25 operating BWRs experienced an average of 2419 h of outage time compared to an average of 3169 h for the 41 operating PWRs. The percentage of forced outage time at BWRs was 37% compared to 46% at PWRs. The primary cause of forced outages at BWRs was equipment failure. At PWRs the primary cause of forced outages was regulatory requirements. Refueling was the primary cause of scheduled outages at both BWRs and PWRs. Implementation of new regulatory requirements and maintenance or testing accounted for large percentages of the scheduled outage time at both types of plants. The dominance of regulatory requirements as the cause for large percentages of forced and scheduled outages was the result of action taken with regard to aspects of the Three Mile Island 2 incident and with regard to concern for seismic design deficiencies in safety-related piping. Fort St. Vrain, an HTGR, declared commercial operation July 1, 1979. For the remainder of the year, the unit acquired an availability factor of 22.2%, having experienced eight forced outages and three scheduled outages for a total outage time of 3434 h.

2109 Process Heat Reactors

REFER ALSO TO CITATION(S) 27791

28004 **(CONF-811101—16) Potential applications of helium-cooled high-temperature reactors to process heat use.** Gambill, W.R.; Kasten, P.R. (Oak Ridge National Lab., TN (USA)). 1981. Contract W-7405-ENG-26. 8p. NTIS, PC A02/MF A01. Order Number DE82004098.

From Winter annual meeting of the ASME Technology and Society Division; Washington, DC, USA (15 Nov 1981).

High-Temperature Gas-Cooled Reactors (HTRs) permit nuclear energy to be applied to a number of processes presently utilizing fossil fuels. Promising applications of HTRs involve cogeneration, thermal energy transport using molten salt systems, steam reforming of methane for production of chemicals, coal and oil shale liquefaction or gasification, and - in the longer term - energy transport using a chemical heat pipe. Further, HTRs might be used in the more distant future as the energy source for thermochemical hydrogen production from water. Preliminary results of ongoing studies indicate that the potential market for Process Heat HTRs by the year 2020 is about 150 to 250 GW(t) for process heat/cogeneration application, plus approximately 150 to 300 GW(t) for application to fossil conversion processes. HTR cogeneration plants appear attractive in the near term for new industrial plants using large amounts of process heat, possibly for present industrial plants in conjunction with molten-salt energy distribution systems, and also for some fossil conversion processes. HTR reformer systems will take longer to develop, but are applicable to chemicals production, a larger number of fossil conversion processes, and to chemical heat pipes.

28005 **(INIS-mf—6628) Nuclear power reactors and hydrogen storage systems.** Ibrahim Aly Mahmoud El Osery. (Institutul de Fizica si Inginerie Nucleara, Bucharest (Romania)). 1980. 25p. (In Romanian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE81700712.

Thesis.

Among conclusions and results come by, a nuclear-electric-hydrogen integrated power system was suggested as a way to prevent the energy crisis. It was shown that the hydrogen power system using nuclear power as a leading energy resource would hold an advantage in the current international situation as well as for the long-term future. Results reported provide designers of integrated nuclear-electric-hydrogen systems with computation models and routines which will allow them to explore the optimal solution in coupling power reactors to hydrogen producing systems, taking into account the specific characters of hydrogen storage systems.

The models were meant for average computers of a type easily available in developing countries.

28006 **(INKA-tr—80/8) Construction and performance testing of a secondary cooling system with hydrogen gas (I). Description of the hydrogen secondary cooling system.** Hishida, M.; Nekoya, S.; Takizuka, T.; Emori, K.; Ogawa, M.; Ouchi, M.; Okamoto, Y.; Sanokawa, K.; Nakano, T.; Hagiwara, T. Translated from *Nippon Genshiryoku Gakkaishi* ; **22**: No. 3, 181-188(1980). 14p. (In German). Fachinformationszentrum Energie, Physik, Mathematik, Karlsruhe, Germany, F.R.

An experimental multi-purpose High-Temperature Gas Cooled Reactor (VHTR) which is supposed to be used for a direct steel-making is now being developed in JAERI. In order to simulate the heat exchanging system between the primary helium gas and the secondary reducing gas system of VHTR, a hydrogen gas loop was constructed as a secondary cooling system of the helium gas loop. The maximum temperature and the maximum pressure of the hydrogen gas are 900°C and 42 kg/cm² x G, respectively. The construction of the hydrogen gas loop was completed in January 1977, and was successfully operated for 1000 h. Various performance tests, such as the hydrogen permeation test of a He/H2 heat exchanger and the thermal performance test of heat exchangers, were made. Especially, it was proved that hydrogen permeation rate through the heat exchanger was reduced to 1/30 to approximately 1/50 by a method of calorized coating, and the coating was stable during 1000 h's operation. It was also stable against the temperature changes. This report describes the outline of the facility and performance of the components.

22 NUCLEAR REACTOR TECHNOLOGY

28007 **Jahrestagung Kerntechnik '81 - Reaktortagung 1981. Tagungsbericht. Sektion 4: Brennstoffkreislauf und Spaltstoffflusskontrolle. (Annual meeting on nuclear technology '81 - Reactor conference 1981. Conference proceedings. Session 4: Fuel cycle and fissile materials safeguards).** Eggenstein-Leopoldshafen, Germany; Fachinformationszentrum Energie, Physik, Mathematik (1981). vp. (CONF-810326—). NTIS (US Sales Only).

From Annual meeting on nuclear technology; Dusseldorf, F.R. Germany (24 Mar 1981).

Each paper summarized in the conference proceedings was indexed separately for the data base. (HDR)

2201 Theory And Calculation

28008 **(CEA-N—2223) Homogeneization: fundamental mode solution of the transport equation. Neutron diffusion coefficient definition and calculation for a one-dimensional heterogeneous slab lattice.** Lam-Hine, M. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Div. d'Etude et de Developpement des Reacteurs; Paris-11 Univ., 91 - Orsay (France)). Jul 1981. 186p. (In French). NTIS (US Sales Only), PC A09/MF A01. Order Number DE81700709.

An exact homogenization method for uniform heterogeneous slab lattices has been developed. A separable solution of the integral transport equation is obtained using the collision probability method. The solution is assumed to be the product of a a macroscopic exponential function depending on a buckling vector of any direction, and a periodical fine structure flux. The collision probabilities depending on the buckling have been calculated. These series are not always convergent; they are summed using P. Wynn epsilon-algorithm. The homogenization process provides an homogeneous medium, defined by a diffusion coefficient and cross sections, which is equivalent to the heterogeneous medium. The drawbacks of P. Benoist diffusion coefficient definition having been considered, new definitions of the homogeneized parameters are proposed. The leakeage coefficient and the Fick law diffusion coefficient are equal and all the reaction rates are preserved. Some numerical comparisons between this homogeneization method and the usualy used approximations have been performed in the one-group theory.

28009 **(HEDL-SA—2540) ASTM standard recommended guide on application of ENDF/A cross section and uncertainty file: establishment of the file.** Lippincott, E.P.; McElroy, W.N. (Hanford Engineering Development Lab., Richland, WA (USA)). Oct 1981. Contract AC06-76FF02170. 6p. (CONF-811070—3). NTIS, PC A02/MF A01. Order Number DE82003767.

From IAEA advisory group meeting on nuclear data for radiation damage and safety; Vienna, Austria (12 Oct 1981).

A new ASTM Standard Recommended Guide on Application of ENDF/A Cross Section and Uncertainty File is in preparation by ASTM Committee E10 on Nuclear Technology and Applications. This ASTM Standard is being prepared in support of the standardization of physics-dosimetry procedures and data needed for Light Water Reactor (LWR) power plant pressure vessel and support structure materials surveillance and test reactor development programs. The main subject of this paper is the estabilishment of the ENDF/A Cross Section and Uncertainty File. The development of evaluated cross section files such as the evaluated nuclear data file, ENDF/B, has occurred mainly to meet the needs of physics calculators. These files are tested by calculations of well-measured benchmark problems such as reactivity or critical mass measurements. Data in the files have then been re-evaluated where disagreements with the benchmark measurements indicate data to be deficient.

28010 (INIS-SU—25, pp 24-32) **Solution algorithm of a multigroup set of the integral kinetic equations in the Psub(L) approximation over the scattering indicatrix.** Knyazev, A.P. 1979. (In Russian). Dep. NTIS (US Sales Only).

From 2. all-union conference on ionizing radiation protection of industrial nuclear plants; Moscow, USSR (19 Dec 1978).

A method to solve a multigroup set of integral reactor kinetic equations with an account of scattering anisotropy in transport Psub(p) approximation is proposed. A solution algorithm is discussed for a plane geometry, which has been realized in the P_1-approximation over the scattering indicatrix in the BKR-h computer code. The code is written in FORTRAN for the BESM-6 computer.

28011 (INIS-SU—39, pp 43-49) **Accuracy evaluation of nuclear reactor gamma spectra reconstruction by the directed divergence method.** Tikhonov, E.G. 1980. (In Russian). Dep. NTIS (US Sales Only).

In Problems on dosimetry and radiation protection. No. 19.

An algorithm of accuracy evaluation of nuclear reactor gamma spectra reconstruction according to the data on integral detectors using the directed divergence method (DDM) is considered. The minimally available value of the distinguishing functional taken in DDM is evaluated by the statistical linearization method. The spectra reconstruction accuracy is studied by the statistical simulation method using the numerical experiment. It is shown that the increase of the number of detectors in the set does not improve the approximation of the real spectrum, but it can increase the reconstruction accuracy while using noncorrelated detectors. The increase of the measurement accuracy considerably improves the solution and reduces its dispersion. To keep high confidence of the results it is necessary to increase the number of detectors, but under the conditions of strong correlation bonds, the requirement of high measurement accuracy does not reduce the solution dispersion. On the basis of the analysis of the results of statistical simulation according to the spectra of different forms the conclusion is made that the spectra reconstruction error while varying only the detector readings depend on the initial data accuracy.

28012 **(KFKI—1981-38) Calculation of foil-activation-correction by Monte Carlo method perturbations in fuel-cells with white boundary conditions.** Lux, I. (Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics). May 1981. 16p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE81700713.

Monte Carlo calculations were performed for estimating the perturbations in the activities of foils in a three-region fuel-cell due to the flux distorting effect of the foils themselves. Theoretical and numerical results show that the relative perturbations in the activities of foils in both the fuel and moderator regions are nearly linear

functions of the "absorption optical thicknesses" of the foils. The results are compared with estimates of other methods.

28013 **Use of perturbation theory in investigating the engineering and physical characteristics of nuclear power plants.** Pupko, V.Ya.; Zrodnikov, A.V. *Soviet Atomic Energy (English Translation);* 48: No. 4, 239-244(Apr 1980).

Some suggestions for the use of perturbation-theory methods in practical engineering-physics investigations are discussed. The problem of determining adequate models for nuclear power plants (NPP) elements with respect to their experimental dynamic characteristics (identification of NPP elements) is considered. 11 refs.

28014 **Calculation of albedo characteristics of multiregion blocks in heterogeneous systems.** Nosov, V.I.; Kompaniets, G.V. *Soviet Atomic Energy (English Translation);* 48: No. 4, 245-248(Apr 1980).

Within the framework of the first collision probability method a procedure has been developed for calculating albedo characteristics of multilayer cylindrical blocks consisting of any number and combination of multiplying, absorbing, and scattering regions. An algorithm for the solution in the multigroup representation was developed for a BESM-6 computer, and a fast program was written for calculating albedo characteristics of a multiregion block of complex composition. The calculated results presented show that the albedo characteristics (matrices) for the most typical heterogeneous properties obtained by the proposed method are no less accurate than the results calculated by the Monte Carlo method. 12 refs.

28015 **Energy distribution of fast neutrons in the F-1 uranium-graphite reactor.** Kanareikin, V.A.; Tyryshkin, V.M.; Yuzgin, V.S. *Soviet Atomic Energy (English Translation);* 48: No. 3, 219-220(Mar 1980).

The first uranium-graphite reactor in Eurasia, the F-1, is now frequently used to produce the special state-standard-unit neutron-flux density. The neutron spectrum in the 0.1 to 10 MeV range was calculated in the middle of a channel passing through the center of the reactor core. This is one of the channels used for the activation of detectors being calibrated. The calculation was performed for a nominal reactor power of 24 kW using a program for solving the adjoint neutron transport equation by the Monte-Carlo method. This program has been successfully used to determine the fast neutron density in the MR reactor and in water-cooled water-moderated reactors. 3 refs.

28016 **Problems of diagnostics of physical characteristics of RBMK reactors according to neutron noise.** Vorontsov, B.A.; Emel'yanov, I.Ya.; Podlazov, L.N.; Rogova, V.D.; Ryabov, V.I.; Svecharevskii, B.M. *Soviet Atomic Energy (English Translation);* 48: No. 3, 161-164(Mar 1980).

The literature contains information about the use of analysis of neutron noise from power reactors to predict resonant instability, to diagnose vibrations and displacements of elements of the reactor construction, etc. The present paper, on the basis of experimental and computational-theoretical investigations, substantiates the possibility and the promise of using statistical methods for operational monitoring and diagnosis of changes in the steam coefficient of reactivity of reactors of the RBMK type under the conditions of commercial operation. 4 refs.

2202 Components And Accessories

REFER ALSO TO CITATION(S) 28211

28017 **(INIS-mf—6619) Contributions to ultrasounds applications in non-destructive tests on materials used in nuclear technologies.** Stanica, V. (Institutul de Reactori Nucleari Energetici, Pitesti (Romania)). 1979. 26p. (In Romanian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE81700708.

The problems expounded in the paper, besides serving the practical purpose generated by the need to perform quality tests on fuel element compounds by means of the ultrasounds method, are also interesting to ultrasounds non-destructive tests applied in all industry branches as they assert the necessity of passing from manual to automation tests carried out by installations which should record the signals caused by failures, both to increase the productivjty and especially to transform it into an objective, effective test.

28018 **(IWGRRPC—79/3) Irradiation embrittlement, thermal annealing and surveillance of reactor pressure vessels, Vienna, Austria, 26 February-1 March 1979.** (International Atomic Energy Agency, Vienna (Austria). International Working Group on Reliability of Reactor Pressure Components). Dec 1979. 230p. (CONF-790234—). NTIS (US Sales Only), PC A11/MF A01.

From IAEA specialists' meeting; Vienna, Austria (26 Feb 1979).

Separate abstracts are presented for each of the conference papers included in the data base.

28019 **Modes of circulation in an inverted u-tube array with condensation.** Calia, C.; Griffith, P. (MIT, Cambridge, Mass). *Journal of Heat Transfer;* 15: 35-43(1981). (CONF-810804—).

From 20. national heat transfer conference; Milwaukee, WI, USA (2 Aug 1981).

An experiment and analysis performed on an inverted U-tube steam condenser (similar to a steam generator) to determine the modes of flow that can exist as the rate of steam flow into the condenser is reduced. The condenser consisted of four largely glass tubes approximately 1.2 m in height connected to a common inlet plenum and a common exit plenum. Heat transfer and flow rate measurements, as well as visual observations were made. 8 refs.

28020 **Stress indices and stress intensification factors of pressure vessel and piping components (symposium), 1981.** Schneider, R.W.; Rodabaugh, E.C. (eds.). New York, NY; ASME (1981). 164p. (CONF-810625—).

From ASME PVP conference; Denver, CO, USA (21 Jun 1981).

Proceedings includes 10 papers which may be viewed as investigations of piping components, and/or interaction between piping components, which contribute to an understanding of this subtly complex subject. Topics covered include: the problem of laterals, stress indices, nozzles, nuclear reactors, piping systems for nuclear power plants, piping elbows, and integral shear lug design. Four papers are abstracted and indexed separately.

28021 **Development of stress indices for eccentric reducers.** Avent, R.R.; Sadd, M.H. (Miss State Univ, Mississippi State). *Journal of Pressure Vessel Technology;* 50: 83-92(1981). (CONF-810625—).

From ASME PVP conference; Denver, CO, USA (21 Jun 1981).

Stress indices have been developed for a number of piping system components. However, little data is available for eccentric reducers. The purpose of this paper is to present the results of a finite element analysis used to obtain stress indices for eccentric reducers. Results are obtained for both mechanical and thermal loadings. A study was first made to determine the range of parameters for typically manufactured reducers. Based on this study, a range of parameters was selected and 36 reducers were analyzed. The resulting analyses were processed to determine stress indices. Only reducers in the thin shell category were treated and bending and stretching elements with six degrees of freedom were utilized. Stress indices were then plotted to determine the effect of various parameters. Approximate equations were obtained for indices as a function of the key parameters. 16 refs.

28022 **Background for the ASME nuclear code simplified method for bounding primary loads in piping systems.** Moore, S.E.; Rodabaugh, E.C. (Oak Ridge Natl Lab, Tenn). *Journal of Pressure Vessel Technology;* 50: 143-164(1981). (CONF-810625—).

From ASME PVP conference; Denver, CO, USA (21 Jun 1981).

The ASME Boiler and Pressure Vessel Code, Section III, contains simplified methods for placing bounds on plastic deformations of piping systems. For Class 1 piping, a simple equation in

terms of B/sub 1/ times a nominal pressure stress and B/sub 2/ times a nominal bending stress is given. The B/sub 1/ and B/sub 2/ stress indices reflect the capacity of piping products to carry load without gross plastic deformation. The basis for the B/sub 1/ and B/sub 2/ indices is described. The significance of the indices, nominal stresses, and limits given in the Code is discussed. The corresponding requirements for Class 2 and Class 3 piping are also discussed. The motivation for the recent Code changes in the indices and in the associated stress limits is presented. 25 refs.

28023 **Linearized transient analysis of nuclear steam generators.** Van Tuyle, G.J.; Lee, J.C. (Brookhaven Natl Lab, Upton, NY, USA). *Nuclear Science and Engineering;* **75**: No. 3, 225-242(Sep 1980).

A linearized formulation of the basic fluid conservation equations for describing the dynamic behavior of nuclear steam generators is presented. The model utilizes a movable boundary spatial discretization technique in one-dimensional geometry and is capable of representing the transient behavior of integral-economizer once-through steam generator (IEOTSG) units in the time and frequency domains. Results of transient calculations performed with the linearized model agree well with other computational results, as well as with the experimental data obtained at a 19-tube IEOTSG test facility. 17 refs.

28024 **Effect of temperature on characteristic of self-powered detectors.** Mitel'man, M.G.; Kononovich, A.A.; Osipov, V.M.; Rozenblyum, N.D. *Soviet Atomic Energy (English Translation);* **48**: No. 4, 263-266(Apr 1980).

Self-powered detectors (SPD) are used extensively in systems for in-reactor monitoring of the distribution of energy release in nuclear reactors. Experience gained from the use of SPD in power reactors showed that they operate stably at a temperature reaching 700/degree/C and no temperature instability of the sensitivity was observed. Here a special study is reported of the influence of temperature on the readings of SPD. 7 refs.

2203 Fuel Elements

REFER ALSO TO CITATION(S) 28205

28025 **(IWGFPT—10) Specialists' meeting on high burnup in power reactors fuel. CEN/SCK - Mol, Belgium, 24-27 March 1981.** (International Atomic Energy Agency, Vienna (Austria). International Working Group on Water Reactor Fuel Performance and Technology). Jul 1981. 134p. (CONF-8103106—). NTIS (US Sales Only), PC A07/MF A01.

From IAEA specialist meeting on high burn-up in power water reactor fuel; Mol, Belgium (23 Mar 1981).

Separate abstracts are presented for each of the conference papers included in the data base.

2204 Control Systems

REFER ALSO TO CITATION(S) 28448

28026 **Experiments on dose reduction in control rods by means of suitable rod insertion programs.** von Charzewski, C.; Presser, W. (Hochtemperatur-Reaktorbau G.m.b.H., Mannheim (Germany, F.R.)). pp 11-14 of Jahrestagung Kerntechnik '81 - Reaktortagung 1981. Tagungsbericht. Sektion 1: Reaktorphysik. Eggenstein-Leopoldshafen, Germany, F.R.; Fachinformationszentrum Energie, Physik, Mathematik (1981).

From Annual meeting on nuclear technology; Dusseldorf, F.R. Germany (24 Mar 1981).

In this dose reduction concept, only part - e.g. half - of the control rods is exposed to the thermal neutron flux. The concept is tested by two-dimensional diffusion calculations in rz geometry using a three-dimensional Monte-Carlo part in the cavity. The computer program permits an exact representation of the control rods in the cavity.

28027 **Possible control of neutron flux by molecular layered compounds.** Gverdtsiteli, I.G.; Kalandarishvili, A.G.; Krivonosov, S.D.; Kuchukhidze, V.A.; Mskhalaya, B.A. *Soviet Atomic Energy (English Translation);* **48**: No. 3, 217-219(Mar 1980).

Many technical solutions have been proposed for controlling the neutron flux in a reactor, among them, controlling by means of channels filled with neutron absorbers in various states of aggregation. The present paper considers the possibility of employing channels filled with layered structures of neutron-transparent and neutron-absorbing substances whose content is determined by the constant of a two-phase equilibrium reaction which is temperature-dependent. 12 refs.

28028 **Axial stability of VVER-1000 reactor with control with minimum standard deviation.** Afanas'ev, A.M.; Torlin, B.Z. *Soviet Atomic Energy (English Translation);* **48**: No. 2, 148-149(Feb 1980).

Results are given of investigations on the stability of a reactor which has, in addition to an automatic controller, a height distribution regulator (HDR) based on an auxiliary control rod (CR) or a special shortened absorption rod (SAR). The HDR was controlled by using either a special ionization chamber (IC), generating an imbalance signal which sets the CR in motion, or two ionization chambers whose difference signal causes a displacement of the SAR. Since data from numerous pickups can be used to control the height field of the VVER-1000, it is of interest to analyze how this would affect the stability of the reactor. The analysis was carried out with the improved IRINA programs. 11 refs.

2205 Environmental Aspects

28029 **Sixteenth DOE nuclear air-cleaning conference.** Bellamy, R.R. (Nuclear Regulatory Commission, Washington, DC); Moeller, D.W.; Underhill, D.W.; First, M.W. *Nuclear Safety;* **22**: No. 3, 347-361(May 1981).

The Sixteenth DOE Nuclear Air-Cleaning Conference was held on October 20-23, 1980, in San Diego, Calif. The 350 air-cleaning specialists who attended were affiliated with governmental agencies, educational institutions, national laboratories, and many sectors of the nuclear industry, representing the United States and 11 foreign countries. Major topics discussed during the conference were waste treatment including volume reduction and storage, system and component response to stress and accident conditions, the Three Mile Island accident, iodine adsorption, the treatment and storage of noble gas, the treatment of off-gases from chemical processing, aerosol behavior, containment venting, laboratory and in-place filter-testing methods, and particulate filtration. The conference focused on the exchange of information among the participants. Air-cleaning research is continuing to move forward in both the United States and foreign countries, yet there are distinct differences in the nature of these efforts. In the European countries, research efforts are directed toward air-cleaning problems associated with the reprocessing of spent fuels. Foreign researchers are also expending considerable time and effort on remote changing and packaging of spent filter elements. Within the United States, research is moving forward on the development of filtered vented containment systems for commercial nuclear power plants, and the use of sand filters in the venting system is once again receiving attention. The Three Mile Island accident of March 1979 and the associated air-cleaning aspects were also discussed at length and in detail during the conference.

2206 Research, Test, And Experimental Reactors

REFER ALSO TO CITATION(S) 27995, 27996, 28031

2207 Plutonium And Isotope Production Reactors

REFER ALSO TO CITATION(S) 28155

28030 **(IKH—97/78) Dynamic loads on reactor vessel components by low pressure waves.** Benkert, J.; Mika, C.; Stegemann, D.; Valero, M. (Hannover Univ. (Germany, F.R.). Inst. fuer Kerntechnik). 1978. 42p. (In German). Hannover Univ. (Germany, F.R.). Inst. fuer Kerntechnik.

Starting from the conservation theorems for mass and impulses the code DRUWE has been developed enabling the calculation of dynamic loads of the reactor shell on the basis of simplified assumptions for the first period shortly after rupture. According to the RSK-guidelines it can be assumed that the whole weld size is opened within 15 msec. This time-dependent opening of the fractured plane can be taken into account in the computer program. The calculation is composed in a way that for a reactor shell divided into cross and angle sections the local, chronological pressure and strength curves, the total dynamic load as well as the moments acting on the fastenings of the reactor shell can be calculated. As input data only geometrical details concerning the concept of the pressure vessel and its components as well as the effective subcooling of the fluid are needed. By means of several parameters the program can be operated in a way that the results are available in form of listings or diagrams, respectively, but also as card pile for further examinations, e.g. strength analysis.

2209 Reactor Safety

28031 **(CEA-CONF—5762) Licensing procedures and safety criteria for research reactors in France.** Berry, J.L.; Lerouge, B. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Surete Nucleaire). Nov 1980. 16p. (CONF-801144—3). NTIS (US Sales Only), PC A02/MF A01. Order Number DE81700686.

From International meeting on development, fabrication, and application of reduced-enrichment fuels for research and test reactors; Argonne, IL, USA (13 Nov 1980).

This paper summarizes the recent evolution of the French research reactor capacity, describes the licensing process, the main safety criteria which are taken into consideration, and associated safety research. Some of the existing facilities underwent important modifications to comply with more severe safety criteria, increase the experimental capabilities or qualify new low-enrichment fuels for research reactors. At the end, a few considerations are given to the consequences of the Osiris core conversion.

28032 **(EPRI-NSAC—2) Mitigation of small-break LOCAs in pressurized-water-reactor systems.** (Electric Power Research Inst., Palo Alto, CA (USA). Nuclear Safety Analysis Center). Mar 1980. 54p. NTIS, PC A04/MF A01. Order Number DE82901454.

The conclusions regarding the TMI accident - as reported by the two major national studies (The President's Commission - Kemeny; and the Rogovin Commission), are that there have been no detectable health effects. This report explores the physical processes which would have had to occur after core damage for the integrity of containment to be threatened. It also describes the signals observable by the operator as the accident becomes progressively more severe. In addition, it provides a systematic framework for evaluating the efficacy of the responses intended to terminate the further progression of the accident.

28033 **(EPRI-NSAC—11) Code for predicting the temperature and oxidation of undercooled cores.** Abramson, P.B.; Bowers, C.H.; Chexal, B.; Henry, R.E.; Honekamp, J.R.; Thomas, G.R. (Argonne National Lab., IL (USA)). Jan 1981. Contract W-31-109-ENG-38. 63p. NTIS, PC A04/MF A01. Order Number DE82004493.

This report documents the status of a computer code developed by Argonne National Laboratory (ANL) and the Nuclear Safety Analysis Center (NSAC) for predicting temperatures and oxidation of a pressurized-water reactor (open lattice) core during an undercooling transient. The initial use of this code has been for analyzing the TMI-2 core initial uncovery and core heat up during the accident of March, 1979. In the initial investigations of the TMI-2 accident, it was concluded that the first major core damage occurred during the first period of complete loss of forced coolant circulation in the core (100 to 174 minutes after turbine trip). The ANL/NSAC core heatup code was originally created to focus on the TMI-2 core during this uncovery period. This focus greatly simplifies the modeling and computational needs through elimination, as either irrelevant or unresolvable, of specific models for the balance of the primary loop and the secondary loop.

28034 **(HEDL-SA—2296-FP) Analyses of hypothetical FCI's in a fast reactor.** Padilla, A. Jr.; Martin, F.J.; Niccoli, L.G. (Hanford Engineering Development Lab., Richland, WA (USA)). 1981. Contract AC06-76FF02170. 23p. (CONF-811101—13). NTIS, PC A02/MF A01. Order Number DE82003790.

From Winter annual meeting of the ASME Technology and Society Division; Washington, DC, USA (15 Nov 1981).

Parametric analyses using the SIMMER code were performed to evaluate the potential for a severe recriticality from a pressure-driven recompaction caused by an energetic FCI during the transition phase of a hypothetical accident in a fast reactor. For realistic and reasonable estimates for the assumed accident conditions, a severe recriticality was not predicted. The conditions under which a severe recriticality would be obtained or averted were identified. 10 figures, 2 tables.

28035 **(PB—82-109703) Nuclear energy risks and benefits.** Jansen, S.D.; Bailey, R.E.; Randolph, J.C.; Hartnett, J.P.; Mastanaiah, K. (Ohio River Basin Energy Study, Urbana, IL (USA)). Sep 1981. 115p. NTIS, PC A06/MF A01.

The report was prepared as part of the Ohio River Basin Energy Study (ORBES), a multidisciplinary policy research program. The study region consists of all of Kentucky, most of West Virginia, and substantial portions of Illinois, Indiana, Ohio, and Pennsylvania. By 1988, coal-fired electrical generating capacity in the region is expected to total over 100,000 MWe, versus about 11,000 MWe projected for nuclear-fueled capacity by that year. Thus, the ORBES emphasis was on coal-fired generation. This report attempts to fill in some of the gaps in the relative lack of emphasis on the risks and benefits of nuclear electricity production in the study region. It covers the following topics: (1) basic facts about radiation, (2) an overview of the current regulatory framework of the nuclear industry, (3) health risks associated with electricity production by LWRs, (4) the risks of nuclear proliferation, terrorism, and sabotage, (5) comparative economics and healthy risks of coal versus nuclear, and (6) the March 1979 accident at Three Mile Island.

28036 **Semiscale program summary: a review of Mod-3 results.** Larson, T.K.; Harvego, E.A. (EG and G Idaho, Inc., Idaho Falls). *Nuclear Safety;* **22**: No. 3, 312-327(May 1981).

The objectives of the Semiscale Program are briefly defined, and accomplishments during the Mod-3 portion of the program are summarized. Significant results from several series of experiments are presented: (1) results from a series of baseline experiments that included large-break blowdown, reflood, and integral blowdown-reflood tests; (2) results from simulations of the transient at the Three Mile Island 2 nuclear power station; (3) experimental findings from a small-break blowdown test series; and (4) miscellaneous experimental results including plant blackout simulations (complete loss of electrical power), upper-head injection drain tests, and natural circulation investigations.

28037 **Pitfalls in current design requirements.** Weaver, W.W. (Babcock and Wilcox, Lynchburg, VA). *Nuclear Safety;* **22**: No. 3, 328-336(May 1981).

It is illogical to continue using some current design requirements in their present form. Specifying design criteria to guard against various occurrences while neglecting an examination of their likelihood is unjustifiable. Probabilistic analyses, followed if necessary by cost-benefit analyses, can focus on and bring into perspective various adverse implications resulting from some deterministic criteria and requirements. Proper use and probabilistic analysis techniques will give system designers latitude in design decisions, thereby eliminating the built-in biases of design philosophy based

on deterministic criteria. This resultant philosophical diversity applied to attaining design goals should be beneficial in reducing risks from nuclear stations.

28038 **Human factors engineering in the US nuclear arena.** Hagen, E.W.; Mays, G.T. (Oak Ridge National Lab., TN). *Nuclear Safety;* **22**: No. 3, 337-346(May 1981).

The chronology of human factors engineering in the US nuclear power industry is highlighted. Human factors engineering is defined as an interdisciplinary specialty concerned with influencing (1) the design of equipment and systems and (2) the management of facilities and operational environments to promote safe, efficient, and reliable man-machine performance. Problems and concerns are coalesced to give a perspective for the next evolutionary phase of human factors engineering application, i.e., the solving of present problems in a reasonable and practical way, thus overcoming previous neglect of an important aspect of nuclear safety.

28039 **Thermal-hydraulics in nuclear power technology (symposium), 1981.** Sun, K.H.; Yao, S.C.; Marinkovich, P.; Dhir, V.K. (eds.). New York, NY; ASME (1981). 86p. (CONF-810804—).

From 20. national heat transfer conference; Milwaukee, WI, USA (2 Aug 1981).

This conference contains 10 papers, all of which are abstracted separately. The papers cover the fundamental theories and phenomena, the performance characteristics of reactor components as well as the behavior of simulated nuclear systems and test reactors. In the fundamental area, the papers are associated with the heat transfer due to condensation in counter-current flooding, the hydrodynamics of a submerged vapor jet, the hydrodynamic criterion of flooding, the prediction of boiling transition, and the stripping at the interface of thermal stratification. The papers in the category of plant system behavior are the study of the response of a scaled boiling water reactor system during a loss-of-coolant accident and the modeling of turbulent flow in the Fast Flux Test Facility.

28040 **Thermal-hydraulic response in the scaled BWR system simulator during a design basis accident simulation test.** Lee, L.S.; Sozzi, G.L. (GE, San Jose, Calif). *Journal of Heat Transfer;* **15**: 1-7(1981). (CONF-810804—).

From 20. national heat transfer conference; Milwaukee, WI, USA (2 Aug 1981).

Emergency core cooling systems are designed to maintain fuel cladding temperature below prescribed limits even under a wide range of hypothetical loss-of-coolant accidents. The effects of the ECC during a design basis accident on the system response were investigated in the BWR system simulator under a cooperative experimental research program sponsored by the Nuclear Regulatory Commission, the Electric Power Research Institute, and the General Electric Company. 14 refs.

28041 **Condensation heat transfer and flooding in a counter-current subcooled liquid and saturated vapor flow.** Dobran, F. *Journal of Heat Transfer;* **15**: 9-19(1981). (CONF-810804—).

From 20. national heat transfer conference; Milwaukee, WI, USA (2 Aug 1981).

This paper develops an analysis of flooding with condensation heat transfer in a vertical tube. The two-phase flow pattern is assumed to be annular with the subcooled liquid adjacent to the tube surface. The core of the tube consists of a homogeneous mixture of saturated vapor and liquid droplets. The adiabatic flooding solution compared well with the experimental data of air-water and air-oil for smooth tube ends. 14 refs.

28042 **Mechanistic accumulator model for light water reactor transient analysis.** Carlson, K.E.; Siegel, D.L.; Ransom, V.H.; Trapp, J.A. (Edgerton, Germeshausen and Grier Inc, Idaho Falls, Idaho). *Journal of Heat Transfer;* **15**: 21-26(1981). (CONF-810804—).

From 20. national heat transfer conference; Milwaukee, WI, USA (2 Aug 1981).

A lumped parameter accumulator model has been developed and installed into the computer program RELAP5. The model includes heat transfer from the wall of the tank, from the water surface to the dome, vaporization from the water surface to the dome, and condensation of vapor in the dome. 5 refs.

28043 **On the prediction of the hydrodynamic flooding criterion.** Yao, L.S.; Sun, K.H. (Univ of Ill, Urbana). *Journal of Heat Transfer;* **15**: 45-51(1981). (CONF-810804—).

From 20. national heat transfer conference; Milwaukee, WI, USA (2 Aug 1981).

The countercurrent flow limitation or flooding is referred to as the situation where the downward liquid flow rate is limited by an updrafting gas flow. The phenomenon is of interest because of its impact on the performance of two-phase flow in packed columns and the effectiveness of reactor coolant injection to the core under loss-of-coolant conditions. The present study focuses on the prediction of hydrodynamic flooding with no downward liquid penetration. 21 refs.

28044 **Improvements to the prediction of boiling transition during boiling water reactor transients.** Philips, R.E.; Shumway, R.W.; Chu, K.H. (Edgerton, Germeshausen and Grier Inc, Idaho Falls, Idaho). *Journal of Heat Transfer;* **15**: 53-62(1981). (CONF-810804—).

From 20. national heat transfer conference; Milwaukee, WI, USA (2 Aug 1981).

The ability to accurately predict the time required to reach a boiling transition in postulated BWR (boiling water reactor) loss-of-coolant accidents is an important step in analyzing the system response to these transients. As part of the effort to develop an advanced BWR system analysis computer code capable of simulating these postulated transients, a study has been undertaken to improve the boiling transition calculations associated with LOCA-type (loss-of-coolant accidents) phenomena. 16 refs.

28045 **Nonequilibrium flashing model for rapid pressure transients.** Aguilar, F.; Thompson, S. (Edgerton Germeshausen and Grier Inc, Idaho Falls, Idaho). *American Society of Mechanical Engineers, [Paper]:* No. 81-HT-35, 1-11(1981).

A detailed, microscopic model for the nonequilibrium flashing of water is coupled to equations describing the bulk liquid state in order to calculate rapid pressure response to an induced liquid strain. The flashing model is predicated on the dynamics of a single bubble growing in an infinite liquid, and it encompasses both the inertia and conduction-limited regimes of bubble growth. The analysis is valid at high temperature; is not limited by the assumption of a thin thermal boundary layer for the bubble or by a prescribed boundary layer shape; and can predict arbitrary pressure transients, both decompressive and recompressive. The chamber-and-piston experiment of Friz et al., is analyzed, and the pressure response of the system is studied for various combinations of two input parameters, bulk nucleation superheat and nucleation site density. 25 refs.

28046 **PWR S/RV line qualification for gas discharge conditions.** Strong, B.R. Jr.; Dogan, T.; Harris, I. (EDS Nucl Inc, San Francisco, Calif). *American Society of Mechanical Engineers, [Paper]:* No. 81-PVP-41, 1-7(1981).

This paper examines the use of the RELAP4/MOD5 thermal-hydraulics code for safety/relief valve discharge into piping networks in PWRs for the problem of steam discharge into air. The examination is more complete than data previously published and includes a comparison of forces developed using EDSFLOW data and a method of characteristics solution for the single line discharge problem. Multi-valve discharge data is also provided. 12 refs.

28047 **Transient dispersed flow film boiling of high pressure water in rod bundle geometry.** Morris, D.G.; Hyman, C.R.; Mullins, C.B.; Yoder, G.L. (Oak Ridge Natl Lab, Tenn, USA). *AIChE (American Institute of Chemical Engineers) Symposium Series;* **77**: 282-289(1981).

Results are reported from recent experiments investigating dispersed flow film boiling of high pressure water in upflow through a rod bundle. The data, obtained under mildly transient conditions, are compared with correlations currently used to predict heat transfer in these circumstances. Experimental testing was

performed at the Oak Ridge National Laboratory in the Thermal Hydraulic Test Facility, a highly instrumented, nonnuclear, pressurized-water loop containing 643.66-m (12-ft) long rods (of which 60 are electrically heated). The rods are arranged in a square array typical of 17*17 fuel rod assemblies in late generation PWRs. Data were collected over typical reactor blowdown parameter ranges. Bundle fluid conditions were calculated with a thermal-hydraulic code assuming homogeneous two-phase flow and thermodynamic equilibrium. Comparisons between the experimentally determined heat transfer coefficients and those calculated by the R.S. Dougall-W.M. Rohsenow correlation indicate that the correlation predicted coefficients are as much as a factor of 2.5 greater than those measured. 13 refs.

28048 **Nuclear reactor safety heat transfer.** Jones, O.C. (ed.). Washington, DC; Hemisphere Publishing Corporation (1981). 959p.

The material in the text is presented in five major sections comprising twenty-four chapters. The first section, entitled "Overview," presents the background material placing nuclear power in perspective. The second section of the text, "Fundamental Concepts," describes the startup and shutdown procedures, typical manevuering transients, faults of moderate and remote frequency, and the concept of design basis accidents. This is done for both water reactor systems (LWR) and liquid metal fast breeder reactor systems (LMFBR). The balance of the textbook is concerned with specific features of LWRs and LMFBRs, specifically concerning the design basis accident-large break guillotine loss of coolant accident (LOCA) in LWRs and the core disruptive accident (CDA) in LMFBRs-and topics of a more general nature. The fifth section, "Special Topics," includes vapor explosions, natural convective cooling, blockages, sodium boiling, and experimental techniques. The section is completed by a brief but thorough description of the sequence of events that occurred during the accident at Three Mile Island.

28049 **Structural reliability of atomic power plant.** Klemin, A.I.; Polyakov, E.F. *Soviet Atomic Energy (English Translation);* **48**: No. 2, 75-83(Feb 1980).

In 1978 the first specialized technical manual "Technique of Calculating the Structural Reliability of an Atomic Power Plant and Its Systems in the Design Stage" was developed. The present article contains information about the main characteristics and capabilities of the manual. The manual gives recommendations concerning the calculations of the reliability of such specific systems as the reactor control and safety system, the system of instrumentation and automatic control, and safety systems. 2 refs.

28050 **Vital area analysis for nuclear power plants.** Varnado, G.B.; Haarman, R.A. (Sandia Lab, Albuquerque, NM). *Nuclear Materials Management;* **9**: 319-327(1980). (CONF-800655—).

From 21. annual meeting of the Institute of Nuclear Materials Management; Palm Beach, FL, USA (30 Jun 1980).

As a part of the review of amended security plans, the U.S. Nuclear Regulatory Commission is using systematic analytic techniques to identify vital areas in all nuclear power plants. The sabotage fault trees provide a structured analytic tool which clearly illustrates the system characteristics and plant features which determine vital areas in each plant. To date the analyses of approximately 30 plants have been performed. This paper discusses the procedures used in this inter-laboratory effort and selected results of the analyses. 13 refs.

28051 **Plant design as an adjunct to physical protection.** Ericson, D.M. Jr. (Sandia Lab, Albuquerque, NM). *Nuclear Materials Management;* **9**: 342-354(1980). (CONF-800655—).

From 21. annual meeting of the Institute of Nuclear Materials Management; Palm Beach, FL, USA (30 Jun 1980).

The potential value is estimated of various configurations of plant design and damage control measures for providing protection against sabotage at commercial light water reactor (LWR) power plants, and the impact of such measures is established on facility costs, operations, and safety. This investigation evolved from earlier studies of the vulnerability of nuclear power plants which identified three types of measures which provide sabotage protection: (1) physical protection or the security system, (2) plant design, and (3) damage control. 12 refs.

25 ENERGY STORAGE

2509 Batteries

28052 **(AD-A—105518/5) Lithium based anodes for solid state batteries. Final scientific report, 30 September 1977-30 September 1980.** Edwards, R.A.H.; Owen, J.R.; Steele, B.C.H. (Imperial Coll. of Science and Technology, London (UK). Dept. of Metallurgy and Materials Science). 30 Jun 1981. 39p. NTIS, PC A03/MF A01.

The work of the two previous reports is reviewed and the last year's work is reported in detail. The latter involved the use of staircase wave cyclic voltammetry, a technique designed to characterize the transport properties of an electrode material over a wide composition range. This technique was applied to the compounds Fex, Si, a glassy metal of composition (Fe95Si7)B15, and a newly found prospective negative plate material HgxLi. An analysis of composite electrodes - those containing an additional ionic conductor, e.g., a solid electrolyte, as the grain boundary phase of the charge storage material shows that the criteria initially applied to the selection of an electrode may be significantly relaxed. Experiments with the composite of lithium-aluminum alloy with the solid electrolyte polyethylene oxide-lithium trifluoromethane sulphonate have verified the analysis which can be applied to many more systems.

28053 **(AD-A—105968/2) Electrochemistry of molten lithium chlorate and its possible use with lithium in a battery.** Wang, S.S.; Bennion, D.N. (Brigham Young Univ., Provo, UT (USA). Dept. of Chemical Engineering). Dec 1980. 36p. NTIS, PC A03/MF A01.

Lithium chlorate, $LiClO_3$, has a reported melting point of 127.6 C or 129 C. The specific conductance of molten lithium chlorate is relatively high compared to most electrolytic solutions used at room temperature. Therefore, lithium chlorate offers the chance to operate a new lithium battery system at a temperature between 130 C and 150 C. It is found from experiments that lithium chlorate is stable in the potential range between 3.2 V and 4.6 V relative to a Li reference electrode. A Li-Cl_3 secondary battery system has an open circuit potential of 3.97 V, making a Li-Cl_3 secondary battery in molten lithium chlorate, in principle, possible. A lithium-lithium chlorate primary battery system is also possible. Lithium negative electrode performance is hindered by corrosion and possible runaway reactions with $LiClO_3$ and dendrite formation on charging. The solubility of Li_2O and LiCl in $LiClO_3$ at 145 C is .000075 mol/cubic cm and .00178 mol/cubic cm, respectively. The diffusion coefficients are 1.5×10^{-7} cm^2/s for Li_2O and 3.4×10^{-7} cm^2/s for LiCl. Platinum appeared to be an inert positive electrode for chlorate, chlorine, or oxygen reactions for short term runs, order of several hours. Nickel shows active-passive behavior which is complex. Nickel appears suitable for primary cell, cathodic discharge of $LiClO_3$, but it does not appear suitable for a Cl_2 or O_2 electrode.

28054 **Brazing method.** Ferry, P.B.; Hall, J.C.; Mccormick, J.T. (to Dept. of Energy). US Patent 4,293,089. 6 Oct 1981. Filed date 8 May 1979. vp.

PAT-APPL-037076.

There is disclosed a positive cathode electrode structure formed by brazing a thin porous membrane to a backing material by preselecting a predetermined area of the thin porous membrane and thereafter providing a braze flow barrier throughout the remainder of the membrane and electrolessly plating a nickelphosphide alloy on the backing material, or in this case the honeycomb structure. The preselected area of the thin porous membrane is placed in intimate contact with the electrolessly plated portion of the backing material and heated to elevated temperatures in the absence of oxygen to form a brazed joint limited to a preselected area. If the braze flow barrier is provided by application of a liquid organic solvent, then the organic solvent is driven off by maintain-

ing the thin porous membrane at elevated temperatures for an extended period of time prior to the brazing operation.

28055 **Development of BN felt separator for Li-Al/MS/sub x/ battery.** Swaroop, R.B.; Battles, J.E. (Argonne Natl Lab, Ill, USA). *Journal of the Electrochemical Society;* **128**: No. 9, 1873-1877(Sep 1981).

Boron nitride felts are being developed and evaluated for application as electrode separators in high temperature Li-Al/MS secondary batteries. Boron nitride fabric has been used as the separator material in most Li/Al/MS/sub x/ cells fabricated thus far. However, BN felt separators are presently under development because they are more porous and potentially less expensive than the BN fabric separators. As a preliminary evaluation, the physical properties of various BN felts were determined. Subsequently, felts were also tested in experimental cells operated for extended periods (greater than 1000 hr). The tests indicated tha the BN felt is compatible with cell components and is stable in the cell environment. 8 refs.

29 ENERGY PLANNING AND POLICY

REFER ALSO TO CITATION(S) 27708

2901 Energy Analysis And Modeling

28056 **Energy, international trade and economic growth.** Manne, A.S.; Kim, S. pp 297-323 of Energy and the developing nations. Auer, P. (ed.). Elmsford, NY; Pergamon Press Incorporated (1981).

From Electric Power Research Institute workshop on energy and the developing nations; Stanford, CA, USA (19 Mar 1980).

Results are reported from a small-analyses. The numerical results are based upon the International trade model that focuses on issues related to energy and economic growth. The analysis provides some broad orders of magnitude as a cross-check upon detailed country-by-country projections, but is not to be viewed as a substitute for these bottom-up analyses. International Bank for Reconstruction and Development (WDR IV) guidelines available in November 1980. The economic assumptions that underlie the model are reviewed and nine alternative cases are presented varying the assumptions with respect to energy supplies, demands, economic growth, and capital flows. It is shown that relatively small differences in supplies (and relatively small differences in the case of demand adjustments to rising prices) can lead to 100% differences in the energy prices projected for 1990. The analysis refers to medium-term economic trends. (MCW)

2902 Economics And Sociology

REFER ALSO TO CITATION(S) 27705, 27711, 28056, 28078, 28081, 28084, 28086, 28089, 28090, 28091, 28092, 28101

28057 (OTA-ISC—153, pp 167-224) **Western energy equipment and technology trade with the USSR.** Nov 1981. NTIS, PC A18/MF A01.

In Technology & soviet energy availability.

The nature and extent of Soviet energy-related purchases from the West are examined. Using available data, an attempt is made to ascertain the magnitude and sources of this trade, to analyze identifiable patterns and trends, and to illuminate the role of the United States in providing material assistance to Soviet energy industries. In the latter context, the paper addresses the issue of foreign availability, i.e., the extent to which the United States is the sole or preferred supplier of energy equipment and technologies that the Soviet Union has purchased in the last five years or is likely to seek during the present decade. The methodology employed survey data of the Soviet oil, gas, coal, nuclear, and electricity transmission industries, together with information on common Western practice to compile a broad list of important energy technologies, items of equipment, and services. This list was refined by using trade statistics to identify those areas in which the USSR has made purchases from the West in the past five years. Major items were then subjected to a foreign availability analysis in which an attempt was made to ascertain which West European and Japanese firms manufacture similar equipment or possess expertise comparable to those companies that actually supplied the USSR.

28058 (OTA-ISC—153, pp 247-279) **Energy and the Soviet economy.** Nov 1981. NTIS, PC A18/MF A01.

In Technology & soviet energy availability.

The energy sector importantly influences and is influenced by the nature and health of the Soviet economy as a whole. Those who formulate energy policy do so in a context which is affected by the structures and performance of the national economy. Their decisions, in turn, help to set the parameters for economic performance. This chapter explores the role of energy in the Soviet economy. It seeks to highlight the economic impacts of alternative plausible levels of Soviet energy availability, and to point out major consequences of various economic eventualities for energy production. The chapter begins with an overview of the Soviet economy, highlighting recent growth trends. This provides a basis for examining the role of the energy sector in that economy, for identifying some of the factors that influence Soviet energy policies, and for describing the recent direction of these policies. The chapter then presents a simplified description of the Soviet economy that can be used to better understand prospects for energy and economic growth in the present decade. It culminates in the development of best and worst case scenarios for Soviet economic growth and energy trade in 1985 and 1990.

28059 (OTA-ISC—153, pp 323-348) **Japanese-Soviet energy relations.** Nov 1981. NTIS, PC A18/MF A01.

In Technology & soviet energy availability.

The dimensions and dynamics of Japan's energy and trade relationship with the Soviet Union are explored from the Japanese perspective. The focus underscores Japan's importance - for both the Soviet Union and for the United States. Japan is the single most important market for Soviet timber and coal, and a potential market for gas produced in Eastern Siberia. Thus, Japanese policy is a critical factor in Soviet economic calculations in Asia. But Japan is also the strongest non-Communist economy in Asia, and Japanese cooperation is important for the success of American foreign policies, globally and toward the region. The chapter outlines the nature of Japan's trade and energy relations with the USSR; explores the domestic organizational and international political context of Japanese policymaking; examines three primary examples of Soviet-Japanese joint energy development; and assesses likely future developments in energy relations between the two nations.

28060 (OTA-ISC—153, pp 349-382) **West European-Soviet energy relations.** Nov 1981. NTIS, PC A18/MF A01.

In Technology & soviet energy availability.

The dimensions of West European energy relations with the Council for Mutual Economic Assistance (CMEA), and particularly with the Soviet Union, are explored. It focuses on four Western nations - the Federal Republic of Germany (FRG or West Germany), France, Italy, and the United Kingdom (UK), examining first past trends in both energy-related equipment exports to, and energy commodity imports from, the USSR. The chapter then turns to the proposed West Siberian gas export pipeline, the controversial project which will significantly increase Soviet gas exports to much of Western Europe. Yamburg, the popular name for this project, which will transport gas initially from the Urengoy field in West Siberia, is used here to illuminate the differing perspectives of these Western nations on increasing East-West trade and energy interdependence, including the costs and benefits associated with such interdependence.

28061 **Aid to nonconventional energy development in the Third World.** Howe, J.W. pp 144-155 of Energy and the developing nations. Auer, P. (ed.). Elmsford, NY; Pergamon Press Incorporated (1981).

From Electric Power Research Institute workshop on energy and the developing nations; Stanford, CA, USA (19 Mar 1980).

A procedure was outlined for testing decentralized renewable energy (DRE) specifically for villages in African countries. The testing procedures involved: determining the performance

technically within the physical conditions of the village; measuring capital costs; determining its compatibility with the local culture; matching the hardware with existing or prospective village institutions that could own, operate, or maintain it; introducing the technology to villages; and determining the effect of the increase in available energy upon such indicators of community well-being as literacy, infant mortality, income, migration, and birth rates. These issues are discussed and the results briefly evaluated. The local support system needed to put in place the technology is discussed. Conflicts over land use (for food or for fuel wood) are discussed and an agenda for action is given. (MCW)

28062 **Energy for rural development.** Hurley, J. pp 173-178 of Energy and the developing nations. Auer, P. (ed.). Elmsford, NY; Pergamon Press Incorporated (1981).

From Electric Power Research Institute workshop on energy and the developing nations; Stanford, CA, USA (19 Mar 1980).

Rural development to increase production and raise productivity as a means of improving the conditions of life is discussed. Rapid population growth rates, energy, growth rates of energy consumption, and petroleum imports are some of the problems mentioned. Conservation, using noncommercial or nonconventional energy sources, and discovering and developing new fossil resources are scenarios discussed that could alleviate some of the problems. The need for better energy information and information dissemination in developing countries is emphasized.

28063 **Energy analysis in countries of Latin America.** Cooper, C.L. pp 413-417 of Energy and the developing nations. Auer, P. (ed.). Elmsford, NY; Pergamon Press Incorporated (1981).

From Electric Power Research Institute workshop on energy and the developing nations; Stanford, CA, USA (19 Mar 1980).

An approach, reflecting specific economic, social, and institutional considerations, to assess the nature and dimensions of a developing country's energy problems, is described. The methodology is discussed. (MCW)

28064 **Energy and development: China's strategy for the 1980s.** Fingar, T. pp 418-445 of Energy and the developing nations. Auer, P. (ed.). Elmsford, NY; Pergamon Press Incorporated (1981).

From Electric Power Research Institute workshop on energy and the developing nations; Stanford, CA, USA (19 Mar 1980).

Economic development in the People's Republic of China is discussed. Agriculture, industry, national defense, science and technology, conservation, coal, concentrating investment in facilities, matching supply and demand, and incentives are discussed. The origins of the present strategy of development are examined. China's emerging energy policy for the 1980s is outlined. (MCW)

28065 **Technik - Umwelt - Zukunft. Eine marxistische Diskussion ueber Technologie-Entwicklung, Oekologie, Wachstumsgrenzen und die 'Gruenen'. (Technology - environment - future. A marxist discussion on technology development, ecology, limits of growth and ecologist groups).** Frankfurt am Main, Germany, F.R.; Marxistische Blaetter (1980). 204p.

This volume contains the materials of the meeting Scientific-technical progress and sociological alternatives organized in March 1980 by the Institute for Marxistic Studies and Research (IMSF). The goal of the meeting was to give a view at the present level of knowledge and discussion among the Federal Republic's Marxists on the direction, the social and ecological consequences of the development of science and technique under the conditions of capitalism. The arguments with the bourgeois opinions of the relation between technique and society was paid special attention to, as well as the discussion on alternative sociological concepts.

2903 Environment, Health, And Safety

REFER ALSO TO CITATION(S) 28065, 28103, 28129, 28475, 28477, 28522, 28536, 28542, 28548, 28673, 28695, 28696, 28697, 28699

28066 (FWS/OBS—80/26, pp 9-11) **National Environment Policy Act and its mandate to applied ecology.** Talbot, L.M.; Bertrand, G.A.; Reisa, J.J. Jun 1980. NTIS, PC A11/MF A01.

From Symposium on biological evaluation of environmental impact; New Orleans, LA, USA (2 Jun 1976).

The National Environmental Policy Act and the establishment of the environmental impact statement process are discussed in reference to the consequent challenges placed on ecological science. It is noted that the most difficult problems facing ecological researchers are how the biological significance of environmental perturbations can be evaluated and how these valuations can be made meaningful to public decision makers.

28067 (FWS/OBS—80/26, pp 12-19) **Scientific logic and the environmental review process.** Cooper, W.E. Jun 1980. NTIS, PC A11/MF A01.

From Symposium on biological evaluation of environmental impact; New Orleans, LA, USA (2 Jun 1976).

The environmental review process is described through a discussion of conflict resolution methodologies. The role of scientific logic in the review process is specifically investigated. The problems concerning the validation of scientific models developed within the environmental impact statement are defined along with those concerning the integration of social weights. The use of general systems theory as a means of integrating the different disciplines necessary for a real environmental review is suggested.

28068 (FWS/OBS—80/26, pp 20-24) **Greening of the environmental decisionmaking process.** Smythe, R.B.; Flamm, B.R. Jun 1980. NTIS, PC A11/MF A01.

From Symposium on biological evaluation of environmental impact; New Orleans, LA, USA (2 Jun 1976).

The development of the environmental impact statement process since 1970 is reviewed. Conclusions are given concerning the role of the environmental scientist in the decision making process and the content of the environmental impact statement. It is suggested that the statements should synthesize the efforts of a multidisciplinary environmental impact assessment team and be more oriented towards analyzing the projected impacts of specific project alternatives rather than presenting general descriptive material.

28069 (FWS/OBS—80/26, pp 40-48) **Evaluating the evaluations: a review perspective on environmental impact assessment.** Kibby, H.; Glass, N. Jun 1980. NTIS, PC A11/MF A01.

From Symposium on biological evaluation of environmental impact; New Orleans, LA, USA (2 Jun 1976).

The role of the U.S. Environmental Protection Agency in reviewing environmental impact statements is examined and the adequacy of ecological assessment methods is discussed. Conclusions are drawn and some suggestions are offered on ways to improve the quality of ecological assessments.

2904 Natural Resources

28070 (NP—2901070) **Objectives of energy supply.** (Regionalverband Mittlerer Oberrhein, Karlsruhe (Germany, F.R.)). Jan 1979. vp. (In German). NTIS (US Sales Only), PC A02/MF A01.

In its series Schriften zum Regionalplan the Regionalverband Mittlerer Oberrhein (Regional Association of the Central Upper Rhine Region) is publishing separate sections of the regional plan. Each of these sections is discussed by the planning committee before publication and then laid open to the Laender planning authorities, cities, communities and districts of the region, as well as to other planning carriers directly concerned. After the hearing, the individual chapters and the hearing results are again discussed by the planning committee and decided by the regional convention.

The present section deals with the energy supply situation of the region.

28071 **(PB—82-126491) Atlas of coal/minerals and important resource problem areas for fish and wildlife in the conterminous United States. Final report.** Honig, R.A.; Olson, R.J.; Mason, W.T. Jr. (Fish and Wildlife Service, Kearneysville, WV (USA). Eastern Energy and Land Use Team). Jul 1981. 116p. NTIS, PC A06/MF A01.

The atlas highlights areas in the conterminous US of potential concern involving coal and minerals development activities and fish and wildlife resources, in particular the Important Resource Problem Areas (IRPs) designated in 1980 by the US Fish and Wildlife Service as areas of emphasis in policymaking. The atlas serves as an initial screening tool for national and regional planners and administrators to help define areas that may require additional analysis prior to development in order to minimize disturbances and adverse impacts on fish and wildlife resources and to protect and enhance these resources where practicable. The publication contains maps of selected mineral resources (coal, copper, geothermal resources, gold, iron, molybdenum, nickel, oil shale/tar sands, peat, phosphate, silver, uranium), IRPs, and Federal Endagered and Threatened Animal Species. (An overlay of the IRP map is provided: by placing this on a mineral map, counties containing both mineral and wildlife resources will be highlighted.) Background information on IRPs, the mineral commodities, and environmental impacts of mineral mining is provided, as well as appendices which tabulate the data displayed in the maps. The document can also be used with a series of 1:7,500,000-scale reproductions of the maps.

28072 (UCRL—52000-82-2, pp 1-10) **How vulnerable are US sources of strategic materials.** Feb 1982. NTIS, PC A03/MF A01.

In Energy and technology review.

Although international political changes may cause temporary interruptions in our supply of certain strategic metals and minerals, the US has many options for reducing the impact of shortages.

28073 **Energy and food in the poor countries.** Revelle, R. pp 110-122 of Energy and the developing nations. Auer, P. (ed.). Elmsford, NY; Pergamon Press Incorporated (1981).

From Electric Power Research Institute workshop on energy and the developing nations; Stanford, CA, USA (19 Mar 1980).

The demands for food and fiber for an ever increasing population in developing countries are discussed. Measures to grow more food and fiber on existing cultivated lands are described; all such measures will demand increased energy supplies. Greater efficiency of energy use, as well as additional sustainable energy supplies is needed for cooking, space heating, and other domestic activities in rural households. These generalizations are discussed by considering the energy strategies in 15 South and East Asian developing countries. The use of wood for fuel and yields from specific trees in certain areas are discussed. It is noted that there is no single short-term solution to the energy problems of the poor countries, but there is an underlying requirement to greatly expand efforts in biological research. (MCW)

28074 **Hunger, energy, and agricultural development.** Cervinka, V.; DeForest, R. pp 123-125 of Energy and the developing nations. Auer, P. (ed.). Elmsford, NY; Pergamon Press Incorporated (1981).

From Electric Power Research Institute workshop on energy and the developing nations; Stanford, CA, USA (19 Mar 1980).

The causes of the progression from food sufficiency to food shortages in Ghana are analyzed. The two major factors contributing to this situation are: philosophy (model of life styles) and energy. These factors are discussed. (MCW)

2906 Nuclear Energy

REFER ALSO TO CITATION(S) 27744, 27972, 28548

2908 Waste Heat Utilization

REFER ALSO TO CITATION(S) 28117, 28133

2910 Conservation

REFER ALSO TO CITATION(S) 28122, 28126

28075 **(AD-A—104448/6) Department of Defense energy management plan, 1980. Annual report No. 2.** (Office of the Deputy Assistant Secretary of Defense (Energy Environment and Safety), Washington, DC (USA)). 1 Jul 1980. 148p. NTIS, PC A07/MF A01.

The central purpose of the Defense energy management program is to assure that the armed forces of the United States have sufficient energy resources to maintain the training, operational readiness, and the combat capability of the strategic and tactical forces. This includes a broad range of interrelated energy programs which include petroleum supply assurance, energy self-sufficiency, and energy conservation and efficiency. Two distinct sets of proposals emerged from the workshop: one set is readily implementable modest program of joint activities as described in 'Individual Working Group Findings'; and the other set is a number of major 'system-side' proposals in the Government-wide implications that require significant evaluation and coordination before they can be implemented (at least one of these proposals--FAST--may require new legislative action).

28076 (OTA-ISC—153, pp 225-245) **Prospects for energy conservation in the USSR.** Nov 1981. NTIS, PC A18/MF A01.

In Technology & soviet energy availability.

The current structure of Soviet energy consumption and recent trends in Soviet energy use are examined. The evaluation of Soviet official policy on energy conservation options available to Soviet planners is described. Recent performance in achieving energy savings is reviewed and the implications for Western policy of Soviet conservation strategies are discussed. (MCW)

28077 **Energy management training for developing countries in the 1980s.** Carroll, T.O. pp 459-470 of Energy and the developing nations. Auer, P. (ed.). Elmsford, NY; Pergamon Press Incorporated (1981).

From Electric Power Research Institute workshop on energy and the developing nations; Stanford, CA, USA (19 Mar 1980).

National energy planning and management courses for developing countries were organized, planned, and conducted. The program includes energy technology assessments for renewable resources utilization, the development of methodologies for carrying out national energy assessments, energy planning models, and energy information systems for LDCs. Field studies in LDCs dealing with energy use in urban and rural households are reported. The need for developments in the technological areas for the LDCs are briefly discussed. (MCW)

2920 Supply, Demand, And Forecasting

REFER ALSO TO CITATION(S) 28056, 28057, 28059, 28060, 28063, 28064, 28073, 28087, 28088, 28126, 28128

28078 (OTA-ISC—153, pp 281-309) **East European energy options.** Nov 1981. NTIS, PC A18/MF A01.

In Technology & soviet energy availability.

The most important international dimension of Eastern Europe's energy problem lies in its relations with the USSR. The Soviet Union's strategy with regard to East European energy combines plans to stabilize the level of its energy exports (i.e., by cut-

ting the increments of energy, especially oil, to be supplied) with assistance to the Council for Mutual Economic Assistance (CMEA) countries in their efforts to develop their own energy resources and to use energy more efficiently. At the basis of this policy seems to be the assumption that tight energy supplies in the USSR preclude increments to shipments comparable to those of the 1960's and 1970's. The purpose of this chapter is to illuminate the degree to which this Sovient strategy is feasible, given the problems and opportunities in domestic energy production and consumption which will confront the nations of Eastern Europe in the next decade. The chapter briefly reviews energy trends in Eastern Euorpe over the last 20 years. It then analyzes the energy problem from both the supply and demand sides, identifying constraints and opportunities and evaluating the political and economic implications for East European energy imports - particularly imports from the Soviet Union. The discussion addresses the important issue of whether Eastern Europe will be able to cover its energy needs with Soviet imports supplementing domestic production, or whether large energy deficits which must be met with other imports may occur. The latter situation could augur heightened domestic political and economic difficulties in Eastern Europe and might necessitate alterations in Soviet policy.

28079 (OTA-ISC—153, pp 383-397) **Soviet energy availability and US policy.** Nov 1981. NTIS, PC A18/MF A01.

In Technology & soviet energy availability.

The debate in the US in terms of whether or not it is in the best interest of the US to institute a policy of helping the USSR increase its energy production is reviewed. Whichever view one holds, the most direct by which the US might affect Soviet energy availability would be by deciding to export or withhold exports of energy (particularly petroleum) equipment and technology to the USSR. Alternatives for formulating a policy on US energy-related exports to the USSR are given. Current US policy and the embargo, linkage, energy cooperation, and commercial perspectives are examined. (MCW)

28080 **Developing countries' energy prospects: a long-term, global perspective.** Basile, P.S. pp 179-196 of Energy and the developing nations. Auer, P. (ed.). Elmsford, NY; Pergamon Press Incorporated (1981).

From Electric Power Research Institute workshop on energy and the developing nations; Stanford, CA, USA (19 Mar 1980).

This paper presents research conducted at the International Institute for Applied Systems Analysis (IIASA). Discussed are (the long-term to the year 2030) energy prospects for Regions IV - Latin America (LA); V - Africa and South and Southeast Asia (Af/SEA); VI - the Middle East and Northern Africa (ME/NAf); and to a limited extent; VII - China and centrally planned Asian economies (C/CPA). The high and low scenarios which were constructed and analyzed by the IIASA Energy Systems Program are summarized.

28081 **Energy demand and structural change in developing countries.** Hoffman, L.; Mors, M. pp 197-241 of Energy and the developing nations. Auer, P. (ed.). Elmsford, NY; Pergamon Press Incorporated (1981).

From Electric Power Research Institute workshop on energy and the developing nations; Stanford, CA, USA (19 Mar 1980).

An examination is made of factors that determine actual energy demand and whether these factors can improve the forecasting of possible future demand. A simple econometric energy demand model is presented. Estimates and projections with the model were undertaken for about 100 countries, which were divided into 14 country groups. Results are described for two country groups - Southern Europe and Low-Income East Africa. (MCW)

28082 **Energy strategy planning process for developing countries.** Starr, C. pp 359-373 of Energy and the developing nations. Auer, P. (ed.). Elmsford, NY; Pergamon Press Incorporated (1981).

From Electric Power Research Institute workshop on energy and the developing nations; Stanford, CA, USA (19 Mar 1980).

The process by which the energy strategy for developing countries may be most usefully planned by them is discussed. The factors addressed are: establishing clearly the relevant objectives and their priorities; delineating as fully as possible the social, cultural, and political conditions which limit the scope of options that may be considered; and analyzing the economic and technical characteristics of the feasible alternatives available. The importance of finding the combinations of these factors to develop the series of alternatives which are feasible is stressed. In an appendix, two examples of rural power applications are examined and factors are determined that are important for the selection of an appropriate technology. (MCW)

28083 **National energy planning in an energy-constrained world.** Palmedo, P.F. pp 374-380 of Energy and the developing nations. Auer, P. (ed.). Elmsford, NY; Pergamon Press Incorporated (1981).

From Electric Power Research Institute workshop on energy and the developing nations; Stanford, CA, USA (19 Mar 1980).

Challenges of long-range energy planning in an energy-constrained world are examined. The need to develop the local institutional capacity to carry out planning functions, the need to devote attention to long-term issues in a time of immediate crisis, the very limited experience throughout the world in this type of planning, and the shortage of adequately trained personnel are discussed as some of the elements of that challenge. (MCW)

28084 **Cooperative energy assessments with developing and industrializing countries.** Summers, R.A.; Cirillo, R.R. pp 381-412 of Energy and the developing nations. Auer, P. (ed.). Elmsford, NY; Pergamon Press Incorporated (1981).

From Electric Power Research Institute workshop on energy and the developing nations; Stanford, CA, USA (19 Mar 1980).

An International Energy Development Program (IEDP), or a Country Energy Assessments program, is a comprehensive, in-depth technical and economic evaluation of a country's energy supply and demand options or strategies corresponding to a set of economic development scenarios. A description of the assessment process and its major elements are presented. The two parts of the analytical process, data base assembly and integrated analysis, are discussed in detail. (MCW)

28085 **Preliminary energy sector assessments of Jamaica.** Yim, H.C. pp 446-458 of Energy and the developing nations. Auer, P. (ed.). Elmsford, NY; Pergamon Press Incorporated (1981).

From Electric Power Research Institute workshop on energy and the developing nations; Stanford, CA, USA (19 Mar 1980).

An assessment of Jamaica's energy supplies shown that swamp peat is its only exploitable energy resource, but eight energy areas for technical and potential development are identified. The tasks of the assessment, referred to as the Preliminary Energy Sector Assessments of Jamaica, are: study integration and project management; economic assessment; solar energy (commercial, industrial, and agricultural); biogas applications; energy conversion from waste; coal prefeasibility study; and electric utility rate analysis. A brief description of the tasks is given. (MCW)

28086 **Energy and development: an overview of selected issues.** Blitzer, C.R. pp 471-490 of Energy and the developing nations. Auer, P. (ed.). Elmsford, NY; Pergamon Press Incorporated (1981).

From Electric Power Research Institute workshop on energy and the developing nations; Stanford, CA, USA (19 Mar 1980).

Issues on the relationship between energy prices and development, the rate of oil/gas exploration, and the substitution of coal for oil imports in the less developed countries are discussed. (MCW)

2930 Policy, Legislation, And Regulation

REFER ALSO TO CITATION(S) 28058, 28079, 28093, 28099, 28110

2940 Fossil Fuels

REFER ALSO TO CITATION(S) 27629, 27645, 27660, 27660, 27661, 27705, 27711, 27711, 27718, 28060

28087 OPEC versus developing nations' energy needs. Fesharaki, F. pp 34-63 of Energy and the developing nations. Auer, P. (ed.). Elmsford, NY; Pergamon Press Incorporated (1981).

From Electric Power Research Institute workshop on energy and the developing nations; Stanford, CA, USA (19 Mar 1980).

Three major issues are considered in this chapter: OPEC's petroleum supply prospects, energy/oil needs of the developing countries, and how OPEC can help alleviate energy problems in developing countries. Forecasts of world energy demand and supply, oil prices and import requirements for developing countries are included. (DMC)

28088 Demand for oil and energy in developing countries. Wolf, C. Jr.; Relles, D.A.; Navarro, J. pp 242-248 of Energy and the developing nations. Auer, P. (ed.). Elmsford, NY; Pergamon Press Incorporated (1981).

From Electric Power Research Institute workshop on energy and the developing nations; Stanford, CA, USA (19 Mar 1980).

How large will the oil and energy demand of the non-OPEC less developed countries (NOLDCs) be in the next decade? Will it be small and relatively insignificant in relation to world demand, or large and relatively important? How will demand be affected by the economic growth of the NOLDCs? This report tries to develop a reasonable range of NOLDC demand forecasts, concentrating on the demand for oil, but also devoting some attention to the total demand for commercial energy. It tries to be explicit about the uncertainties associated with the forecasts, and with the income and price elasticities on which they are based. Finally, we wish to consider the implications of these estimates for US policies concerning NOLDCs, North-South relations, the world oil market and for future research on energy issues relating to NOLDCs.

28089 Energy and international trade issues. Waelbroeck, J.L. pp 267-274 of Energy and the developing nations. Auer, P. (ed.). Elmsford, NY; Pergamon Press Incorporated (1981).

From Electric Power Research Institute workshop on energy and the developing nations; Stanford, CA, USA (19 Mar 1980).

Adjusting to sharp increases in oil prices is the topic of this chapter. The economic logic of the adjustment process is discussed. Both short-term and long-run adjustment problems are described. The mechanisms through which energy affects trade and the world's economy are analyzed. (DMC)

28090 Changing relative energy prices, the balance of payments, and growth in developing countries. Hughes, H. pp 275-296 of Energy and the developing nations. Auer, P. (ed.). Elmsford, NY; Pergamon Press Incorporated (1981).

From Electric Power Research Institute workshop on energy and the developing nations; Stanford, CA, USA (19 Mar 1980).

The question of whether petroleum prices are a convenient excuse for slow growth is addressed. The impact of changing petroleum prices on the developing countries is difficult to evaluate because of the political atmosphere. The sharpness of the increases, rather than the increase per se, led to accelerated inflation and balance-of-payments difficulties. An overview of economic development processes is presented and the impact of the 1973-74 petroleum price increases on economic growth is discussed. Current balance-of-payment concerns and thoughts about the likely evaluation of developing-country growth during the 1980's are included.

28091 Oil, OPEC, and LDC balance of payments: impacts and opportunities. Mossavar-Rahmani, B.; Pryor, C.A. pp 324-338 of Energy and the developing nations. Auer, P. (ed.). Elmsford, NY; Pergamon Press Incorporated (1981).

From Electric Power Research Institute workshop on energy and the developing nations; Stanford, CA, USA (19 Mar 1980).

The effects of rapid rises in oil prices on the economies of developing countries (LDC) are discussed in this chapter. Since not all LDC are oil importing countries, their economic ills cannot be totally blamed on OPEC policies. LDC oil importers as well as exporters have experienced large balance-of-payment deficits. Possible solutions to the long-term balance-of-payment problems are addressed. (DMC)

28092 Iranian syndrome: political symptoms and economic causes of too rapid modernization. Copaken, R. pp 339-343 of Energy and the developing nations. Auer, P. (ed.). Elmsford, NY; Pergamon Press Incorporated (1981).

From Electric Power Research Institute workshop on energy and the developing nations; Stanford, CA, USA (19 Mar 1980).

The complex set of reasons for preferred production profiles that stretch reserve depletion over longer periods and result in a conservative desire to avoid excessive domestic spending is what is meant by the Iranian Syndrome. The political manifestations and economic causes for the Iranian Syndrome are discussed. Energy supplies and demand in developing countries and limited oil production by OPEC nations are evaluated.

28093 Energy strategies for oil-importing developing countries. Alonso, M. pp 344-358 of Energy and the developing nations. Auer, P. (ed.). Elmsford, NY; Pergamon Press Incorporated (1981).

From Electric Power Research Institute workshop on energy and the developing nations; Stanford, CA, USA (19 Mar 1980).

The effects of energy cost increases on economic growth and overall development are seen by developing countries from many different perspectives. Probably the best criterion to use to identify common positions is whether the country is and will remain in the foreseeable future a net oil exporter or a net oil importer. Here there is a clear line demarcating quite different issues and strategies. While no country, either developed or developing, is totally devoid of energy resources, for most of them the price and availability of oil are more critical than the price and availability of any other sources of energy, given the present energy supply-and-demand patterns and the constraints to change these patterns. This paper concentrates on the energy strategies of oil-importing developing countries, most of which are characterized by (1) large population growth rates, (2) profound differences in the quality of life among urban and rural segments of the population, (3) an increasing demand for energy to satisfy minimum standards of living both in urban and rural areas, and (4) chronic scarcity of investment capital and foreign exchange. To place the issue in the proper context, an overview of energy consumption and development strategies in developing countries is presented, taking as an example the situation in Latin America.

2950 Hydrogen And Synthetic Fuels

REFER ALSO TO CITATION(S) 27797

2960 Electric Power

28094 (CONF-811206—2) Probabilistic dynamic security assessments. Tsai, Y.K. (California Univ., Berkeley (USA)). 1981. Contract AC01-79ET29364. 9p. NTIS, PC A02/MF A01. Order Number DE82002997.

From 20. IEEE conference on decision and control; San Diego, CA, USA (16 Dec 1981).

This paper presents a comprehensive framework for probabilistic dynamic security assessment. The time to insecurity is used as the measure of system security. The probability distribution of the

time to insecurity is obtained from the solution of a linear vector differential equation whose coefficients are expressed in terms of steady-state and dynamic security regions. The procedure for the computation of these regions are indicated. An illustrative example is given.

28095 (OTA-ISC—153, pp 143-165) **Soviet electric power industry.** Nov 1981. NTIS, PC A18/MF A01.

In Technology & soviet energy availability.

The difficulties encountered in and the prospects for generating electricity at powerplants fired by fossil fuels in the USSR, the ability of the USSR to construct high voltage (HV) power transmission lines, the formations of power systems and the problems associated with managing these systems are described. The present and prospective role of electric power in supplying energy to the Soviet economy is analyzed and the changes in generating capacity and output, in location of generating stations, and in technology and equipment which must take place for this role to expand are discussed. Present activities in and plans for electricity transmission lines and integrated networks, the present and potential contributions of the West in each of these areas, and Soviet prospects for meeting growing electricity demands and for fulfilling existing plans for the addition of installed electricity capacity and growth in electricity production are examined.

28096 **(PB—82-109208) Legal and institutional aspects of interstate power plant development in the Ohio River Basin energy study region.** McLaughlin, J.C. (Ohio River Basin Energy Study, Urbana, IL (USA)). Sep 1981. 197p. NTIS, PC A09/MF A01.

The report was prepared in support of the Ohio River Basin Energy Study (ORBES), a multidisciplinary policy research program. It discusses both the present legal and institutional setting of power plant siting and development and possible legal and institutional means to solve problems in this setting. One potential vehicle, interstate compacts, also receives extensive treatment. The report draws upon experiences in the six states in the ORBES study region--Illinois, Indiana, Kentucky, Ohio, Pennsylvania, and West Virginia. The specific topics covered include present federal policy that necessitates efficient interstate coordination of power development; existing, proposed, and potential federal laws; state siting law; state law as a solution to the coordination problem; the interstate compact as a device for interstate cooperation and coordination; the interstate compact as a device for interstate coordination problem; judicial review; and the use of electric utility industry regional and national organizations.

28097 **(PB—82-109380) Ohio basin interstate energy options: constraints of federalism.** Keenan, B.R. (Ohio River Basin Energy Study, Urbana, IL (USA)). Sep 1980. 98p. NTIS, PC A05/MF A01.

The report was prepared as part of the Ohio River Basin Enery Study (ORBES), a multidisciplinary policy research program. It addresses regional and interstate approaches to power plant siting and operations in the ORBES study region, which consists of all of Kentucky and substantial portions of Illinois, Indiana, Ohio, Pennsylvania, and West Virginia. Among the topics covered are power plant impacts in the federal context, interstate air quality conflicts and available remedies, air quality control possibilities, water-related considerations, and the interstate structure of the power industry.

28098 **(NP—2901844) Electricity pricing: choices for the 80's. American attitudes on electricity pricing and economic growth.** (Union Carbide Corp., New York (USA). Corporate Communications Dept.; Cambridge Reports, Inc., MA (USA)). [nd]. 70p. Union Carbide Corporation, Communications Dept., 270 Park Ave., New York, NY 10017.

An analysis of a survey of public attitudes toward the problem of electricity supply and cost in the US and toward a number of pricing policy options is presented. A survey sample of 1001 adult consumers was used to assess overall public concern about the supply of electric power, to meassure public attitudes toward electric utilities and the rates they charge, and to determine attitudes toward various electric utility rate issues. The results indicate the following public attitudes. Conservation and reliance on coal-fueled power plants should be promoted to assure adequate power supplies. Support for additional nuclear power plants to increase power supply is approximately equally divided. Electric utilities are perceived as doing a good job. Electricity prices have risen less than other cost-of-living items. The cost of power plant fuels is the most significant factor in increasing power prices. The slowdown in nuclear power plant construction is not likely to influence power prices. Power prices should be based on cost-of-service, but not when this pricing method results in much lower industrial rates as compared with residential rates. (LCL)

2980 Consumption And Utilization

REFER ALSO TO CITATION(S) 28110, 28112, 28113, 28114

28099 **(ILLDOE—81/29) Illinois energy plan. Illinois energy consumption trends: 1960 to 2000.** (Illinois Dept. of Energy and Natural Resources, Springfield (USA)). Sep 1981. 151p. Illinois Dept. of Energy & Natural Resources, Rm. 300, 325 W. Adams St., Springfield, IL 62670.

An attempt is made to design an energy plan which is consistent with the following state policies: maintaining economic development and job opportunities; protecting the environment; expanding non-conventional energy resources; conserving energy resources; using the most abundant and saving the least available energy resources; being as equitable as possible to all income groups and regions in the state; allowing energy prices to reflect replacement cost; and maintaining certainty in energy policy. The purposes of this document are to describe how Illinois currently uses energy, to establish a common base line to discuss energy issues, and to give direction to future research and analysis within the context of the energy planning process. Another major purpose of this publication is to consider Illinois' energy outlook if current trends in energy consumption and production continue, without modification, into the future. Historical trends in energy consumption and consumption trends by sectors are discussed in detail. The impacts of energy price escalations on Illinois households and businesses are addressed as well as the potential state trade imbalance resulting from the growing dependence on energy imported from outside Illinois. (MCW)

28100 **(NP—2902271) Alternatives for utility meter reading.** Holland, G.W. (Public Technology, Inc., Washington, DC (USA)). Mar 1980. 27p. Public Technology, Inc., 1140 Connecticut Ave. NW, Washington, DC 20036.

The manual monitoring of electricity, water, and gas meters is a slow, costly, and error-prone process for the small city utilities delivering these services. More efficient methods, which are the focus of this report, include: consumer responsibility for meter reading; radio communicated meter reading; computerized on-site utility billing; computerized on-site meter reading/central billing; automatic remote meter reading/central billing; and infra-red meter access. Each method is described with its advantages, limitations, and capital costs. However, the assessment of applicability for each system must obviously be conducted in light of the unique financial, political, and time restrictions of any particular municipality. (LCL)

28101 **Energy and development: crisis and transition.** Gordon, L. pp 1-12 of Energy and the developing nations. Auer, P. (ed.). Elmsford, NY; Pergamon Press Incorporated (1981).

From Electric Power Research Institute workshop on energy and the developing nations; Stanford, CA, USA (19 Mar 1980).

The relationship between energy use and economic development is briefly examined. The energy situation in today's developing country is summarized. The central theses of this overview are that the developing countries constitute an increasingly important component of the global energy scene, that their problems of energy management overlap those of the industrial world but are even more difficult, and that there is a shared interest in mitigating the short-term crises now confronting them and in securing their full participation in the longer-term transition in energy regimes on which the world is now embarked. (MCW)

28102 **Energy consumption and decentralized solutions.** Goldemberg, J. pp 98-109 of Energy and the developing nations. Auer, P. (ed.). Elmsford, NY; Pergamon Press Incorporated (1981).

From Electric Power Research Institute workshop on energy and the developing nations; Stanford, CA, USA (19 Mar 1980).

Present trends are discussed which show the increase of populations to migrate to the cities where energy is supplied by centralized systems. Efforts being made to implement small-scale technologies, particularly with renewable energy sources, in rural areas around the world are examined. An analysis of the existing data for the US, Norway, and Brazil is made to show that larger incomes are tied closely to large energy expenditures in rural and urban areas. It is pointed out that a policy of decentralization (and an attempt to supply the energy needs of small communities from small renewable dispersed sources) might be useful in improving present living conditions from an energy saving point of view, but it does not represent an advantage when compared to a policy of encouraging urbanization. (MCW)

2990 Unconventional Sources And Power Generation

REFER ALSO TO CITATION(S) 27661, 27814, 27824, 27826, 28061

28103 **(NP—2902095) Global energy in transition: environmental aspects of new and renewable sources for development.** Bassan, E. (Sierra Club International Earthcare Center, New York (USA)). Jul 1981. 135p. UNIPUB, 345 Park Ave. South, New York, NY 10010.

Technical, development, and environmental aspects of the following alternative sources are assessed: solar energy, wind energy, energy from the oceans, hydropower, geothermal energy, biomass, fuelwood and charcoal, peat, oil shale and tar sands, and draft animal power. Policy issues for energy planning and development are presented for: rural energy, industry and transport, and financing new and renewable sources of energy. Summaries of the following national reports are included: China, Federal Republic of Germany, Hungary, Jamaica, Korea, Pakistan, Peru, Sudan, and United States. (MHR)

28104 **Trees and straws.** Smil, V. pp 126-143 of Energy and the developing nations. Auer, P. (ed.). Elmsford, NY; Pergamon Press Incorporated (1981).

From Electric Power Research Institute workshop on energy and the developing nations; Stanford, CA, USA (19 Mar 1980).

The amount of phytomass remaining in the world's forests and how fast it is disappearing are discussed. Its spatial distribution, its net productivity, and the amount that can be harvested on a sustained basis are covered. The amount that forest fuels are contributing to the current energy balance of the developing world is estimated. Data are compiled on forested areas, the rate of the disappearance of forests, and component breakdown of biomass in some selected forests. The estimated consumption rates of fuelwood in India, Bangladesh, Thailand, Ghana, and Zambia are tabulated. The supply and uses of crop residues with emphasis on cereal straw are discussed. (MCW)

28105 **Coordination of renewable energy projects: an agenda for action.** Ashworth, J.H. pp 156-172 of Energy and the developing nations. Auer, P. (ed.). Elmsford, NY; Pergamon Press Incorporated (1981).

From Electric Power Research Institute workshop on energy and the developing nations; Stanford, CA, USA (19 Mar 1980).

Systems for renewable energy technologies were evaluated at a workshop meeting sponsored by the US Agency for International Development (USAID) and the US Solar Research Institute (SERI). Planners from bilateral and multilateral donor agencies, private foundations, and developing countries discussed what information on renewable energy systems they would like from other organizations. An outline of the general categories of information that the participants considered necessary for the planning of any renewable energy project is given. (MCW)

30 DIRECT ENERGY CONVERSION

3001 Mhd Generators

REFER ALSO TO CITATION(S) 27635

28106 **Combined conduction, convection, gas radiation, and particle radiation in MHD diffusers.** Ahluwalia, R.K.; Im, K.H. (Argonne National Lab., Ill). *International Journal of Heat and Mass Transfer;* **24**: No. 8, 1421-1429(Aug 1981).

Heat transfer in MHD diffusers, by conduction, convection, gas radiation, and slag-particle radiation, is analyzed by simultaneously solving the radiation-transport equation and a set of quasi-three-dimensional gasdynamic equations. Carbon dioxide, water vapor, and potassium atoms are considered to be the principal gases participating in gas radiation. For a reference diffuser geometry appropriate for a 1700-MW thermal MHD plant, the heat transfer by convection is found to be 25 MW, and the radiative heat transfer varies from 44 to 79 MW, depending on the rate of ash carryover into the channel. 15 refs.

28107 **Two-dimensional performance analysis and design of MHD channels.** Doss, E.; Geyer, H.; Ahluwalia, R.K.; Im, K. (Argonne National Lab., Ill). *Journal of Fluids Engineering;* **103**: No. 2, 307-314(Jun 1981).

A two-dimensional model for MHD channel design and analysis has been developed for three different modes of operation: velocity, Mach number, and pressure. Given the distribution of any of these three parameters along the channel, the channel aspect ratio, and the channel operating conditions, the MHD channel geometry can be predicted. 25 refs.

28108 **On coal conversion with a variable-pressure combustor.** Roy, G.D.; Lanier, J.H.; Vidyasagar, N.S. (Univ of Tennessee, Tullahoma). *AIChE (American Institute of Chemical Engineers) Symposium Series;* **77**: 191-198(1981).

Coal conversion is studied experimentally with a variable-pressure combustor for application to magnetohydrodynamic (MHD) generators. Heat transfer and gas analysis are used as the diagnostic tools to evaluate combustor performance, and plasma conductivity to evaluate performance as applied to MHD generators. A 'coal-burn' model, when used with proper coal properties, is found to predict adequately the performance. The effect of combustor pressure on heat transfer and plasma conductivity are also reported. 6 refs.

3003 Thermoelectric Generators

REFER ALSO TO CITATION(S) 27789, 27790

28109 **(INIS-SU—57, pp 65-77) Optimization of temperatures of junctions of the thermoelectric converter of a radioisotope generator.** Markar'yan, B.N. 1980. (In Russian). Dep. NTIS (US Sales Only).

In Radiation techniques. Issue 19. Questions of nuclear science and techniques.

Optimization of junction temperatures by efficiency and specific electric capacity of generator have been carried out for rational choice of temperature range of thermoelectric converter of radioisotopic generator. It is shown that realization of temperature optimization of heat absorbing and heat generating junctions of thermoelectric converter of radioisotopic generator is possible on the base of specified analytical correlations. Disregarding temperature dependences of loading coefficients, coefficients of heat conductivity of generator element material and their geometry can result in essential error in determining optimal temperatures of junctions. Applicability of these assumptions should be grounded in every certain case.

3005 Fuel Cells

REFER ALSO TO CITATION(S) 27634

32 ENERGY CONSERVATION, CONSUMPTION, AND UTILIZATION

28110 **(ILLDOE—81/39) Illinois energy consumption trends, 1960 to 2000. Executive summary.** (Illinois Dept. of Energy and Natural Resources, Springfield (USA)). 1981. 3p. Illinois Dept. of Energy and Natural Resources, Rm. 300, 325 W. Adams St., Springfield, IL 62670.

Findings and projections are excerpted from Illinois Energy Consumption Trends: 1960 to 2000 in this summary. It describes historical trends in Illinois energy consumption as well as projected trends through the year 2000 for all the consuming sectors. (MCW)

3201 Buildings

REFER ALSO TO CITATION(S) 27658, 27795, 27813, 27860, 27885, 27886, 28231, 28233, 28234, 28235, 28237

28111 **(BMFT-FB-T—81-076) Microprocessor-based control unit for heating systems comprising solar collectors and/or heat pumps.** Arend, H.O. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). 1981. 61p. (In German). Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.).

In connection with utilizing fuels as well as regenerative energy sources, heating systems become increasingly complex and differentiated. On the basis of vlsi-components (microprocessor) a universal heating control system with integrated malfunction diagnostic system has been developed allowing both conventional as well as modern bi- and multi-source-energy heating systems to be operated at optimum efficiency. The use of microprocessors has significantly simplified installation and operation of such systems (orig.).

28112 **(CONF-811030—3) Energy audits at 48 hospitals.** Hirst, E. (Oak Ridge National Lab., TN (USA)). 1981. Contract W-7405-ENG-26. 6p. NTIS, PC A02/MF A01. Order Number DE82002814.

From 4. world engineering congress; Atlanta, GA, USA (12 Oct 1981).

Staff at the Oak Ridge Associated Universities (ORAU) conducted energy audits at 48 hospitals in four states (New York, Pennsylvania, Virginia, Tennessee) between 1978 and 1980. Staff at the Oak Ridge National Laboratory (ORNL) and ORAU developed and organized a computerized data base containing information from these audits. This paper describes the ORAU audit process; summarizes the data collected from these audits on hospital characteristics annual energy use, and the audit recommendations; and analyzes the audit data in terms of cost-effectiveness, type of recommendations, and the relationship between potential energy saving and characteristics of the individual hospital.

28113 **(ILLDOE—81/28) Value of energy conservation: a local perspective.** (Illinois Inst. of Natural Resources, Springfield (USA)). Jul 1981. 49p. Illinois Dept. of Energy and Natural Resources, Rm 300, 325 W. Adams St., Springfield, IL 62670.

This report analyzes the costs and benefits of a hypothetical residential energy conservation program designed to provide ten inches of ceiling insulation (R-30) in 17,500 dwelling units in Springfield, Illinois. The proposed conservation program would establish a revolving loan fund to be financed initially by the sale of $5.0 million in local utility revenue bonds. Residents taking advantage of the program would repay their loans through their utility bills, over a period of five years. The study indicates the program would be beneficial. Up to 30 percent of the energy required for the space heating of homes involved in the program would be saved. Over the 25 year life of the bonds, residents are projected to save over $200 million (1981 dollars) in avoided energy costs.

28114 **(ILLDOE—81/33) Residential sector: the demand for energy services.** (Illinois Inst. of Natural Resources, Springfield (USA)). 1981. 139p. Illinois Dept. of Energy and Natural Resources, Rm. 300, 325 W. Adams St., Springfield, IL 62670.

The purpose of this report is to project the demand for residential services, and, thereby, the demand for energy into the future. The service demands which best represent a complete breakdown of residential energy consumption is identified and estimates of the amount of energy, by fuel type, used to satisfy each service demand for an initial base year (1978) are detailed. These estimates are reported for both gross (or input) energy use and net or useful energy use, in the residential sector. The various factors which affect the consumption level for each type of energy and each identified service demand are discussed. These factors include number of households, appliance penetration, choice of fuel type, technical conversion efficiency of energy using devices, and relative energy efficiency of the building shell (extent of insulation, resistance to air infiltration, etc.). These factors are discussed relative to both the present and expected future values, for the purpose of projections. The importance of the housing stock to service demand estimation and projection and trends in housing in Illinois are discussed. How the housing stock is projected based on population and household projections is explained. The housing projections to the year 2000 are detailed. The projections of energy consumption by service demand and fuel type are contrasted with the various energy demand projections in Illinois Energy Consumption Trends: 1960 to 2000 and explains how and why the two approaches differ. (MCW)

28115 (LBL—12100, pp 5-7) **Feasibility study of two-well storage systems for combined heating and air-conditioning by groundwater heat pumps in shallow aquifers.** Pelka, W.; Tsang, C.F. Jul 1981. NTIS, PC A12/MF A01. Order Number DE82000804.

In Earth Sciences Division annual report 1980.

The numerical model is applied to the problem of two-well storage systems for a number of hypothetical examples based on realistic aquifer parameters and climatic data. The transient flow field and temperature field around the warm-water and cold-water wells, extraction temperatures, recovery factors, and energy fluxes are calculated for a period of three years. (MHR)

28116 **(LBL—13399) Efficient daylighting in thermally controlled environments.** Ne'eman, E.; Selkowitz, S. (Lawrence Berkeley Lab., CA (USA)). Oct 1981. Contract W-7405-ENG-48. 14p. (CONF-811109—4). NTIS, PC A02/MF A01. Order Number DE82003045.

From 1981 international passive and hybrid cooling conference; Miami Beach, FL, USA (11 Nov 1981).

Many of the design considerations required to enable a design team to utilize daylight to the maximum possible extent are reviewed in order to reduce electric lighting loads and associated building energy-consumption. Among steps that must be taken is a thorough analysis of all heating and cooling loads inside the building and the heat exchange through the building envelope. Data on local climate and sunshine availability must also be considered. Although the energy aspects have recently dominated design considerations, daylight's influence on human well-being is gaining importance. In this respect, the variability of daylight, the quality of its spectral composition, the view out, and health effects are along the aspects that should be considered when determining an appropriate role for daylighting in energy-efficient buildings.

28117 **(NP—2901206) Raton, New Mexico power plant waste-heat utilization for space heating of buildings. Phase I: Technical and economic feasibility study. Final report, 3/1/81 - 9/30/81.** Conrad, G.C.; Munson, J.B. (New Mexico State Univ., Las Cruces (USA). Physical Science Lab.). Feb 1982. 77p. (EMD—2-69-1205). New Mexico Energy Research and Development Inst., P.O. Box 5307, Santa Fe, NM 87502.

This report presents findings of a study showing the technical and economic viability of raising the turbine back pressure of an existing coal-fired steam/electric power plant at Raton, NM, to provide 180 deg hot water in large quantitites from the condenser

(cooling water). The feasibility of converting an existing, unused swimming pool to a thermal storage reservoir allows off-peak production of the hot water for heating school buildings throughout the day. The power plant and school buildings modification costs can be recovered in five to ten years.

28118 **(ORNL/CON—78) Analysis of energy use at US institutional buildings.** Hirst, E.; Trimble, J.; Goeltz, R. (Oak Ridge National Lab., TN (USA)). Nov 1981. Contract W-7405-ENG-26. 41p. NTIS, PC A03/MF A01. Order Number DE82004670.

The Federal Institutional Conservation Program includes collection of energy use and energy-related data from individual institutional buildings. Data were obtained from ten states (Massachusetts, New Hampshire, Vermont, New Jersey, Florida, Minnesota, Wisconsin, Texas, Kansas, and Oregon) on almost fifteen thousand schools, hospitals, local government buildings, and public care institutions. After the data were carefully examined, organized, and validated (i.e., outliers that might be errors were deleted), regression equations were developed for each of the four institutional building types. Because so many of the data elements were either missing or outliers, techniques were applied that allow incorporation of observations with missing data in the regression analysis. These equations explain annual energy use as functions of average energy price, floor area, year of construction, occupancy, air conditioning, primary heating fuel, owner, location, and building function. These equations explain roughly 20 to 40% of the variation in energy use among these buildings. Although there were some differences among building types in the magnitude and statistical significance of the coefficients for different terms, there was also considerable similarity. In particular, the coefficients for energy price were always negative and statistically significant at the 1% level or better (with long-run elasticities of about -0.6), and the coefficients for year of original construction were always positive and significant.

28119 **(PB—82-108580) NBIR seminar: energy conservation in commercial buildings.** (National Building Research Inst., Pretoria (South Africa)). 27 Nov 1979. 133p. NTIS, PC A07/MF A01.

A partial listing of topic areas includes: Designing for optimal thermal performance; Energy management in existing buildings; Total systems design in air conditioning and lighting; Solar water heating; Hot water and space heating installations for a large hostel; Alternative energy sources for the heating and cooling of a building; The architectural approach to energy conservation in an office building.

28120 **(PB—82-113580) The effect of form and orientation on the radiant solar heat load on buildings under zambian conditions.** Gouveia, B.A. (National Council for Scientific Research, Lusaka (Zambia)). Apr 1970. 14p. NTIS, PC A02/MF A01.

The solar load on a building is related to the geographic location of the building, i.e., latitude, altitude, climate, etc., the form of the building, the orientation of the building and the surface details of the building. This study takes into account the first three variables, i.e., geography, form, and orientation, and attempts to provide a comparative tool for design decisions and a specification for detailed design.

28121 **(PB—82-117516) Review of research on heating and climatization 1979, produced by CIB Steering Group 17.** (Conseil International du Batiment pour la Recherche l'Etude et la Documentation, Rotterdam (Netherlands)). 1979. 155p. NTIS, PC A08/MF A01.

This publication is the 1979 Review of Research and it contains information from many countries on current research activities in the field of heating and climatization. Research information is set out under general subject titles and for each title the projects are grouped under national headings. The information includes project description, research manager, project period, staffing levels, and current publications.

28122 **(PB—82-124173) Energy efficient building program needs assessment.** (Anderson and Berdie Associates, Inc., St. Paul, MN (USA)). Mar 1981. 90p. NTIS, PC A05/MF A01.

The Minnesota Energy Agency initiated this needs assessment to provide a better understanding of the decisions that determine the energy efficiency of new buildings and to determine how those decisions may be influenced. This needs assessment is to provide information and guidance for the development and implementation of educational programs to improve energy efficiency of new building design and construction in Minnesota. This also includes the present practice of energy efficiency in new building design and construction, the barriers preventing design and construction aimed toward energy efficiency, the types of information that can be provided to assist in improving new building energy efficiency, and the most productive delivery mechanisms for such information.

28123 **(SAI—444-80-311-LJ) Additional cooling and heating load improvements in seasonal performance modeling of room and central air conditioners and heat pumps. Topical report, Subtask 3.2.** (Science Applications, Inc., La Jolla, CA (USA)). 9 Apr 1980. Contract AC04-79AL10757. 139p. NTIS, PC A07/MF A01. Order Number DE82003826.

The study focuses on improving the load modeling technique of Seasonal Performance Model (SPM) in order to estimate a more realistic load for seasonal analysis calculations on an hourly basis. A computer simulation program, Seasonal Performance Model Load (SPMLD), was used to calculate the cooling and heating loads for a typical residence in Caribou, Maine; Columbia, Missouri; and Fort Worth, Texas. The derivation of the SPMLD is described and changes made to improve cooling and heating load estimates are identified. (MCW)

28124 **Determination of woodstove efficiency under in-home conditions.** Barnett, S.G. (SUNY, Plattsburgh). pp 996-1037 of Residential solid fuels: environmental impacts and solutions. Cooper, J.A.; Malek, D. (eds.). Beaverton, OR; Oregon Graduate Center (1982).

From 1981 international conference on residential solid fuels; Portland, OR, USA (1 Jun 1981).

A technique is described which measures the delivered efficiency of woodstoves in homes. The test home, a well insulated and weatherstripped 1400 square foot raised ranch, is located in the town of Plattsburg in northernmost New York State, where annual degree days average 8000. The home's heat loss per degree day was measured by metering electric heat loads while the home was both occupied and unoccupied for 38 days. Only those electric heaters located in the area where the woodstove was to be operated were used. The Plattsburgh National Weather Service hourly temperature records and a continuous recording thermograph in the home provided average inside-outside temperature differences. Solar gain was measured utilizing a solar meter and percent sunshine data from the Burlington, Vermont NWS station. A multiple regression model was used to evaluate the significance of two additional variables: (a) the effect of wind on infiltration and (b) heat storage. Only heat storage was shown to be significant. Woodstove efficiency was determined by comparing the energy content of daily wood burned (adjusted for moisture content) with the home's net daily heat loss over continuous periods of 6 to 36 days for each stove. Five types of medium sized woodstoves (20 to 22 sq ft area) have been evaluated during the past three winters. These include a thin-walled convective box heater, double-door unbaffled step stove, cross-draft stove (two brands), true downdraft stove, and a new prototype stove. A new thermostatic device developed by the author was also tested. All tests were made at typical burning rates for the northeast (two to about seven pounds per hour) using air-dried native hardwoods.

28125 **Reflective insulating blinds for windows and the like.** Barnes, P.R.; Shapira, H.B. (to Dept. of Energy). US Patent 4,292,763. 6 Oct 1981. Filed date 7 Dec 1979. vp.

PAT-APPL-101367.

Energy-conserving window blinds are provided. The blinds are fabricated from coupled and adjustable slats, each slat having an insulation layer and a reflective surface to face outwardly when the

blinds are closed. A range of desired light and air transmission may be selected with the reflective surfaces of the slats adapted to direct sunlight upward toward the ceiling when the blinds are open. When the blinds are closed, the insulation of the slats reduces the heat loss or gain produced by the windows. If desired, the reflective surfaces of the slats may be concave. The edges of the slats are designed to seal against adjacent slats when the blinds are closed to ensure minimum air flow between slats.

3202 Transportation

REFER ALSO TO CITATION(S) 27652, 27653, 28135, 28136

28126 (PB—82-107939) Energy: forecasting, data, and conservation. Bertram, K.M.; Mannering, F.L.; Harrington, I.E.; Boyce, D.E.; Janson, B.N. (Transportation Research Board, Washington, DC (USA)). 1981. 106p. NTIS, PC A06/MF A01.

The 14 papers in this report deal with the following areas: projected potential piggyback energy savings through the year 2000; use of density function and Monte Carlo simulation techniques to evaluate policy impacts on travel demand; direct energy consumption for personal travel in the Chicago metropolitan area; short-term forecasting of gasoline demand; issues for developing state energy emergency conservation plans; analysis of long-term transportation energy use; state-level stock system model of gasoline demand; fuel consumption on congested freeways; measures of the impacts of changes in motor-fuel supply in Massachusetts; dual price system for management of gasoline lines; projections of changes in vehicle technology and characteristics to improve fuel economy; framework for analyzing the 1979 summer fuel crisis: the New York state experience; simulating the impact of transportation-related energy policies on travel behavior and transportation demand; and an assessment of games as methods of providing information on gasoline conservation.

28127 (PB—82-116625) Rolling resistance measurements in 106 passenger car tires. Technical report. Klemer, G. (Environmental Protection Agency, Ann Arbor, MI (USA)). Aug 1981. 44p. NTIS, PC A03/MF A01.

The study investigates a diverse range of tires currently available on the replacement passenger car tire market. One hundred-six tires from fifty different model lines were tested. The rolling resistance of these tires are analyzed against other tire characteristics (tire construction, new versus retread, etc.) to gain insight as to the effects of these characteristics on vehicle fuel economy.

28128 (PB—82-123779) Follow-up and reevaluation traffic studies on gasoline rationing. Asp, K.; Thunberg, B. (Statens vaeg- och Trafikinstitut, Linkoeping (Sweden)). 1980. 48p. (In Swedish). NTIS, PC A03/MF A01.

Follow-up investigations are important in connection with any eventual rationing of automotive fuel, in order to determine if the rationing is achieving its purpose and that unwanted secondary effects have not arisen. These studies would also keep the public informed and be useful in winning its support for rationing. The effectiveness of rationing is determined by three complementary methods: (1) traffic counts, (2) speed measurement, and (3) a study of travel habits.

28129 (PB—82-126111) Preliminary calculation of fuel economy adjustment factors. (Environmental Protection Agency, Ann Arbor, MI (USA)). Jul 1981. 47p. NTIS, PC A03/MF A01.

This report is a dual purpose report: (1) it is a cover report for EPA Final report 460/3-81-003, Development of Adjustment Factors for On-Road Fuel Economy, and (2) it is a preliminary determination of fuel economy adjustment factors in support of ongoing fuel economy rulemaking activity. In its role as a cover for the EPA report, it extracts key findings, critiques the findings, and offers modifications to the findings where there is reason to adopt alternate assumptions. In its rulemaking support role as an initial estimate of MPG adjustment factors, it compares the EEA (Energy And Environmental Analysis) results with those of other recent, significant publications in this area. The resulting preliminary adjustment factors herein are thus an amalgam of the factors derived by these four data sources.

3203 Industry And Agriculture

REFER ALSO TO CITATION(S) 27643

28130 (AD-A—105479/0) Process energy inventory at Iowa Army Ammunition Plant, Load Line 3. Final report, January-December 1980. Thompson, D.W.; Hadenfield, G.L.; Lowry, A.P. (Mason and Hanger-Silas Mason Co., Inc., Middletown, IA (USA)). Sep 1981. 45p. NTIS, PC A03/MF A01.

A comprehensive process energy audit was conducted at the Iowa Army Ammunition Plant, Load Line 3. The energy consumption baseline was determined for four production items: cartridges M106, M650E5, M17A1, and M337A1E1. This report includes a brief description of the production process for each item, corresponding process flow charts, and estimates of potential savings. The potential savings for production of all four items total $22,244 or 6680 M Btu of energy per year, a reduction over current consumption of 28%.

28131 (PB—81-153918) Economic feasibility of using fly ash in the ceramic and concrete/cement industries, Mercer County, North Dakota. (Mercer County Energy Development Board, Hazen, ND (USA)). Jun 1980. 119p. NTIS, PC A06/MF A01.

The Energy Development Board of Mercer County (EDB) has prepared an economic diversification plan to guide Mercer County's efforts to prevent negative effects from the rapid growth it is experiencing. This economic diversification plan seeks not only to provide the means to diversify the local employment base, but also to take advantage of ongoing energy development. The plan has three general objectives: economic development, energy resource conservation, and resource recovery. As a first step in carrying out the economic diversification plan, EDB staff conducted a preliminary screening of potential new industries for Mercer County. Fly-ash based products proved to be the industry that currently best fulfilled all three general objectives of the economic diversification plan. It could provide a new source of employment, conserve energy resources, and provide a means to use a product that is currently discarded.

28132 (PB—82-128596) Energy conversion potential of industrial waste streams. Final report. Coxe, E.; Berger, E.; Riggenbach, J. (Reynolds, Smith and Hills, Jacksonville, FL (USA)). Sep 1977. 325p. NTIS, PC A14/MF A01.

This study examines the feasibility of using incineration with heat recovery as an alternate approach for managing hazardous wastes. Industrial wastes from the following eight major industries are discussed: organic chemicals, plastics, pharmaceuticals, petroleum refining, tires and inner tubes, fabricated rubber products, paints, and solvent reclaiming. The study addresses the theme of whether the value of recovered energy is sufficient to justify incineration with heat recovery, both from a technical and a cost basis.

28133 US chemical plant chooses slow-speed diesel cogeneration system. Davis, J.P.; Nydick, S.E. (Thermo Electron Corp., Waltham, MA). *Modern Power Systems;* 1: No. 11, 57-62(Dec 1981).

The Hoffmann-La Roche chemical plant in New Jersey is installing a residual fuel-fired, slow-speed, two-stroke diesel cogeneration unit that will eliminate the need for purchased electricity. A prerequisite for the economic viability of such a cogeneration plant is the authorization or possibility to sell surplus (or all) electricity produced at a fair market price. Regarding actual rates of return of power from cogenerators to utilities, one of the most-attractive regulations has recently been passed by the US Federal Energy Regulatory Commission. Not only the acceptance of electric power from cogenerators has become mandatory for utilities, but it prescribes take-over prices at avoided costs which are in certain cases higher than selling rates. Avoided costs are defined as the cost of both energy and capacity a utility would avoid as a result of the genera-

tion of power by a cogenerator. Since avoided costs are, by definition, equal to or greater than average costs, this avoided cost principle improves the economic viability of cogeneration projects. This positive climate has in fact prompted the US Department of Energy to promote the building of this first cogeneration plant in the world with slow-speed large bore diesel engines. This type of diesel is used as the most successful prime mover of all ocean going ships world wide. For power generation, it can be found in many European, African, and Middle East countries, but none in the USA. The system is scheduled for operation in late 1982. 6 figures, 1 table.

3206 Municipalities And Community Systems

REFER ALSO TO CITATION(S) 27788, 28100

28134 (PB—81-151557) Processing equipment for resource recovery systems. Volume III. Field test evaluation of shredders. Final report. Savage, G.M.; Shiflett, G.R. (Cal Recovery Systems, Inc., Richmond, CA (USA)). Jul 1980. 137p. NTIS, PC A07/MF A01.

This report presents the results of a program to test and evaluate large-scale shredders used for the size reduction of solid waste. In all, tests were conducted on seven horizontal hammermills, one vertical hammermill, and one vertical ring shredder at six commercial sites. Both two stage size reduction and single stage size reduction were studied as part of this work. Evaluation and interpretation of the data have resulted in the development of analytical relationships among the comminution parameters and the establishment of levels of performance with respect to energy consumption and hammer wear associated with size reduction of solid waste.

33 ADVANCED AUTOMOTIVE PROPULSION SYSTEMS

28135 (DOE/SF/01182—T8) Program plan report for applied research in road vehicles. (TRW, Inc., McLean, VA (USA). Energy Systems Planning Div.). Jul 1977. Contract AM03-76SF01182. 56p. NTIS, PC A04/MF A01. Order Number DE82004354.

Current federal, international, and industrial activities in research aimed to reducing the energy consumed by automobiles is reviewed. This research involves vehicle design, advanced propulsion systems, alternative fuels, traffic management, and improved automotive components such as bearings, tires, and combustion systems. (LCL)

3301 Internal Combustion Engines

REFER ALSO TO CITATION(S) 28139

28136 (PB—82-112400) Compilation of inspection/maintenance facts and figures. Technical report. Armstrong, J.; Tierney, E. (Environmental Protection Agency, Ann Arbor, MI (USA). Inspection and Maintenance Staff). Jun 1981. 22p. NTIS, PC A02/MF A01.

Since the passage of the 1977 Amendments to the Clean Air Act, a great deal of information has been assembled about vehicle inspection and maintenance (I/M) programs. Laboratory studies, surveys, and investigations of operating I/M programs have been conducted to quantify the costs and benefits and to project the impact of these programs on air quality. This report compiles and summarizes the latest technical information available from these studies for the use of policy makers and planners. The facts and figures in this report have been gathered from the technical reports referenced at the end of the document. Interested readers are encouraged to obtain these reports for additional information.

28137 (PB—82-112434) Discussion of the selection coverage and frequency alternatives in inspection and maintenance programs. Technical report. Armstrong, J.A. (Environmental Protection Agency, Ann Arbor, MI (USA). Inspection and Maintenance Staff). Aug 1981. 20p. NTIS, PC A02/MF A01.

Automobile Inspection/Maintenance (I/M) program managers are faced with many decisions when designing and implementing an emissions inspection program on how to best serve the needs of their local area. All of these decisions are impacted by both technical and socio-economic considerations. This report will examine those decisions which concern the coverage of the program and the frequency of inspection. Specifically, this report addresses the concerns surrounding the selection of the geographic area, vehicle classes, and model years included in the program. Additionally, this report discusses the impact of including change-of-ownership inspection and/or random roadside checks along with the annual cycle.

3303 Electric-powered Systems

28138 (PB—81-970847) Evaluation of electric-vehicle-propulsion system: tests reveal the performance data of an automatic transmission, motor controller, and dc motor. NTIS tech note. (Army Materiel Development and Readiness Command, Alexandria, VA (USA)). Nov 1981. 1p. For information about subscribing to Tech Notes, please write NTIS Subscription Dept.

This citation summarizes a one-page announcement of technology available for utilization. A report by the U.S. Army Mobility Equipment Research and Development command discusses the procedures and results of the performance evaluation of an experimental electric-propulsion system. The propulsion system is powered by sixteen 6-volt traction batteries. A thyristor controller actuated by a foot throttle controls the voltage applied to a dc series field motor rated at 10 hp (7.3 kW) at 3,800 rpm. The system also includes a three-speed automatic transmission. The objective was to determine the commercial applicability, maintainability, and energy utility of the system to establish a design base for the further development of this or a similar system. Detailed information about the technology described may be obtained by ordering the NTIS report, order number: AD-A080655.

3307 Emission Control

REFER ALSO TO CITATION(S) 28137

28139 (PB—81-153793) Evaluation of the Stone Industrial Corporation copper-plated combustion chamber concept. (Environmental Protection Agency, Ann Arbor, MI (USA)). Jul 1973. 7p. NTIS, PC A02/MF A01.

Stone Industrial Corporation of College Park, Maryland, has had a long-term development project related to a copper-plated combustion chamber concept for reciprocating internal combustion engines. A majority of their experience with this concept has been with Diesel engines. Their work has shown reduction in Diesel smoke levels and some improvement in fuel economy. As an extension of this effort and to investigate the effect of their copper-plated combustion chamber concept in a light duty automotive application, Stone prepared two gasoline-powered vehicles. The Emission Control Technology Division was contacted by Stone in regard to conducting confirmatory testing on these vehicles. Emissions data from these vehicles presented by Stone demonstrated the potential of achieving low levels of all three emissions. Thus, test work was undertaken by the Test and Evaluation Branch.

3308 Alternative Fuels

REFER ALSO TO CITATION(S) 27652, 27653, 27799

36 MATERIALS

28140 (NP—2901234) Research in materials. Annual report. (Massachusetts Inst. of Tech., Cambridge (USA)). Jan 1982. 448p. Massachusetts Institute of Technology, Cambridge, MA.

The twenty-first issue of the Annual Report on Research in Materials at the Massachusetts Institute of Technology is presented. This publication represents a broad view of the materials research programs currently conducted in the academic departments of Physics, Chemistry, Electrical Engineering and Computer Science, Materials Science and Engineering, Mechanical Engineering, Chemical Engineering, and Ocean Engineering. In addition, there are summaries included for the Francis Bitter National Magnet Laboratory on materials research at high magnetic fields, as well as the materials research program in the Solid State Division of Lincoln Laboratory. The individual sections of the Annual Report review the technical accomplishments for the year for each of the research groups. Interaction between staff from different departments indicates the trend toward increased interdisciplinary activities in materials research.

3601 Metals And Alloys

REFER ALSO TO CITATION(S) 27633, 27943, 27976, 27979, 27983, 27984, 27986, 27988, 28018, 28229

28141 (CEA-CONF—5724) Disk pressure test a sensitive test method of material embrittlement. Arnould-Laurent, R.; Fidelle, J.P. (CEA Centre d'Etudes de Bruyeres-le-Chatel, 92 - Montrouge (France)). Dec 1980. 6p. (In French). (CONF-801269—4). NTIS (US Sales Only), PC A02/MF A01. Order Number DE81700706.

From 3. colloquium on the development of metal investigation methods; Saint-Etienne, France (3 Dec 1980).

A mechanical test for characterizing embrittlement of materials under stress and non-homogeneous deformation is described. In this test a disk, fixed at the periphery, is broken by an increasing gas pressure, pressures obtained are compared in standard conditions and in conditions producing brittleness. The ratio between these two pressures is a quantitative measurement of the damage. Fracture morphology gives indications on embrittlement.

28142 (CONF-811122—20) Rapidly solidified long-range-ordered alloys. Lee, E.H.; Koch, C.C.; Liu, C.T. (Oak Ridge National Lab., TN (USA)). 1981. Contract W-7405-ENG-26. 5p. NTIS, PC A02/MF A01. Order Number DE82004121.

From Annual meeting of the Materials Research Society; Boston, MA, USA (16 Nov 1981).

The influence of rapid solidification processing on the microstructure of long-range-ordered alloys in the (Fe, Co, Ni)$_3$ V system has been studied by transmission electron microscopy. The main microstructural feature of the as-quenched alloys was a fine cell structure ($\sim$ 300 nm diameter) decorated with carbide particles. This structure was maintained aftr annealing treatments which develop the ordered crystal structure. Other features of the microstructures both before and after annealing are presented and discussed. 6 figures.

28143 (INIS-SU—61, pp 29-33) Peculiarities of radiation damages in titanium alloys with various interstitial contents. Kozhevnikov, O.A. 1979. (In Russian). Dep. NTIS (US Sales Only).

From 7. Bakurianian school on radiation physics of metals and alloys; Bakuriani, USSR (Feb 1979).

The radiation stability of VT1-0 and VT1-1 titanium with an elevated concentration of hydrogen has been studied under neutron irradiation (10^{20} fast neutron/cm^2). It has been found by the electron microscopic autoradiography method that neutron irradiation causes hydrogen redistribution in chemical bond-alloys. In radiative defects there appear a great number of small hydride depositions, which favours some increase in impact viscosity. At an elevated concentration of other implanted elements (oxygen and nitrogen) the negative effect of hydrogen on radiative embrittlement is observed even at small amounts of the latter.

28144 (LBL—13015) Investigation on the enhancement of the critical current densities in bronze-process Nb_3Sn. Hong, M.; Wu, I.W.; Morris, J.W. Jr.; Gilbert, W.; Hassenzahl, W.V.; Taylor, C. (Lawrence Berkeley Lab., CA (USA)). Oct 1981. Contract W-7405-ENG-48. 22p. (CONF-810835—38). NTIS, PC A02/MF A01. Order Number DE82003901.

From 1981 cryogenic engineering conference; San Diego, CA, USA (10 Aug 1981).

The work reported here addressed the problem of improving the critical current characteristic of a comercial multifilamentary Nb_3Sn strand by varying its heat treatment. The work was done from the perspective that the critical current characteristic is controlled by the metallurgical state of the reacted layer, which is, in turn, fixed by the processing the wire has undergone. The research was carried out in parallel with metallographic studies which analyzed the microstructure and composition profile within the reacted Nb_3Sn layer as a function of heat treatment. The combined results of metallographic and processing research suggest that it is possible to engineer the microstructure of the reacted layer to improve J/ sub c/(H). The specific product of the work is a tailored double-aging treatment which introduces a favorable combination of microstructure and composition in the reacted layer and causes a substantial improvement in the critical current characteristic of the strand.

28145 (LBL—13359) Why ductile fracture mechanics. Ritchie, R.O. (Lawrence Berkeley Lab., CA (USA)). Oct 1981. Contract W-7405-ENG-48. 33p. (CONF-811101—12). NTIS, PC A03/MF A01. Order Number DE82003621.

From Winter annual meeting of the ASME Technology and Society Division; Washington, DC, USA (15 Nov 1981).

Until recently, the engineering application of fracture mechanics has been specific to a description of macroscopic fracture behavior in components and structural parts which remain nominally elastic under loading. Whilst this approach, termed linear elastic fracture mechanics, has been found to be invaluable for the continuum analysis of crack growth in brittle and high strength materials, it is cleary inappropriate for characterizing failure in lower strength ductile alloys where extensive inelastic deformation precedes and accompanies crack initiation and subsequent propagation. Accordingly, much effort has been devoted in recent years towards the development of nonlinear or ductile fracture mechanics methodology to characterize fracture behavior under elastic/plastic conditions; and effort which has been principally motivated by problems in nuclear industry. In this paper, the concepts of ductile (elastic/plastic) fracture mechanics are introduced and applied to the problem of both stationary and nonstationary cracks. Specifically, the limitations inherent in this approach are defined, together with a description of the microstructural considerations and applications relevant to the failure of ductile materials by fracture, fatigue and creep.

28146 (PB—81-152274) Minerals yearbook 1977. Volume I. Metals and minerals. (Bureau of Mines, Washington, DC (USA)). 1980. 1075p. NTIS, PC A99/MF A01.

This report contains chapters on virtually all metallic and nonmetallic mineral commodities important to the domestic economy. In addition, it includes a general review chapter on the mineral industries, a chapter on mining and quarrying trends, and a statistical summary.

28147 (PB—81-152282) Minerals yearbook 1976. Volume II. Area reports: domestic. (Bureau of Mines, Washington, DC (USA)). 1980. 848p. NTIS, PC A99/MF A01.

This report contains chapters on the mineral industry of each of the 50 States, the US inland possessions in the Pacific Ocean and the Caribbean Sea, and the Commonwealth of Puerto Rico. This volume also has a statistical summary, identical to that in Volume I.

28148 (PB—81-152290) Minerals yearbook 1976. Volume III. Area reports: international. (Bureau of Mines, Washington, DC (USA)). 1980. 1402p. NTIS, PC A99/MF A01.

This report contains the latest available mineral data on more than 130 foreign countries and discusses the importance of minerals to the economies of these nations. A separate chapter re-

views the international mineral industry in general and its relationship to the world economy.

28149 **(PB—81-803991) Stress corrosion of steel. 1964-January 1981 (citations from the NTIS Data Base.). Report for 1964-Jan 1981.** (National Technical Information Service, Springfield, VA (USA)). Feb 1981. 356p. NTIS PC N01/MF N01.

The citations cover crack propagation, fracture, tests, surface finishing, working, coatings, deformation, and fatigue in relation to stress corrosion. The majority of studies in this report are on nuclear reactor, aircraft, and spacecraft materials. Stainless steel stress corrosion is excluded. (This updated bibliography contains 349 citations, 50 of which are new entries to the previous edition.)

28150 **(PB—81-859753) Amorphous alloys: magnetic properties. January 1966-December 1980 (citations from the Metals Abstracts Data Base). Report for Jan 1966-Dec 1980.** (New England Research Application Center, Storrs, CT (USA)). Feb 1981. 189p. NTIS PC N01/MF N01.

This retrospective bibliography contains citations on the magnetic properties of amorphous alloys. Both ferrous and non-ferrous alloys are included. Magnetostriction, magnetic anisotropy, magnetic permeability, magnetic moments, and magnetoresistivity are discussed in terms of alloying constituents and their concentration in the alloy. (Contains 245 citations, fully indexed and including a table of contents.)

28151 **(SAND—81-1356C) Metallurgy and microstructures of pulse melted alloys.** Follstaedt, D.M. (Sandia National Labs., Albuquerque, NM (USA)). 1981. Contract AC04-76DP00789. 11p. (CONF-811122—24). NTIS, PC A02/MF A01. Order Number DE82003578.

From Annual meeting of the Materials Research Society; Boston, MA, USA (16 Nov 1981).

The microstructures found in pulse metals are reviewed. Epitaxial resolidification and the defects found in pure metals are discussed. Pulse melted alloys are then examined in order of increasing complexity. First, single phase alloys which solidify into metastable solid solutions are discussed. For higher concentrations and liquid-insoluble species, phase separation can occur, and the requirements for such separation are identified. If precipitation does not reduce the impurity concentration of the liquid, the liquid may be quenched to an amorphous solid. Comparisons of ion-implantation and pulse-melt produced amorphous alloys are given.

28152 **(WAPD-TM—1489) Effect of neutron irradiation on the mechanical properties of type 348 stainless steel in-pile pressure tubes.** Fischer, R.L. (Bettis Atomic Power Lab., West Mifflin, PA (USA)). Jun 1981. Contract AC11-76PN00014. 46p. NTIS, PC A03/MF A01. Order Number DE82004739.

This report presents the results of a post-irradiation destructive examination of a Type 348 stainless steel inpile pressure tube, which was removed from the Advanced Test Reactor after exposure to a peak fluence of 3.2×10^{22} n/cm^2 (E > 1.0 MeV). This in-core portion of the tube operated under a hoop stress of 10,500 psi at a mean wall temperature of 725°F. The test results indicate the occurrance of radiation saturation of the tensile, elongation, and fracture toughness properties, a reduced but adequate 800°F creep-rupture strength, and the absence of 800°F notch sensitivity. Radiation induced changes in density and thermal diffusivity were minimal. The material incurred an in-reactor creep of 1.8% and a concomitant stress relaxation. Transmission electron microscopy also indicates that radiation-induced lattice damage had achieved saturation.

28153 **Failure control mechanisms in the indium-4140 steel solid and liquid metal induced embrittlement system.** Kassner, M.E. (California Univ., Livermore (USA). Lawrence Livermore National Lab.). *Res Mechanica Letters;* **1**: No. 10, 463-469(Oct 1981).

4140 steel, heat treated to a nominal strength of 1370 MPa was embrittled by indium (Tm = 429 K). For the In-4140 steel system, the following experiments were undertaken: (1) delayed failure tests at temperatures above and below the melting point of indium: the temperature dependence of the failure controlling process(es) could then be evaluated; (2) at selected stresses and temperatures in the liquid metal induced embrittlement and solid metal induced embrittlement range, interrupted delayed failure tests, where tensile samples are unloaded prior to a previously determined nominal failure time, were conducted to determine when during the static fatigue process cracks first begin to appear. These tests provided direct information as to whether the crack nucleation time or propagation rate controls the specimen failure time. Results are presented and discussed.

28154 **High temperature corrosion in energy systems.** Rapp, R.A. (Ohio State Univ., Columbus (USA). Dept. of Metallurgical Engineering); Devan, J.H. (Oak Ridge National Lab., TN (USA)); Douglass, D.L. (California Univ., Los Angeles (USA). Dept. of Materials); Nordine, P.C. (Yale Univ., New Haven, CT (USA). Dept. of Engineering and Applied Science); Pettit, F.S. (Pittsburgh Univ., PA (USA)); Whittle, D.P. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). *Materials Science and Engineering;* **50**: No. 1, 1-17(Sep 1981).

At high temperatures, particularly in response to the unique environments associated with the conversion or combustion of fossil fuels, further fundamental studies of alloy reactions with mixed gaseous oxidants are required. The specific corrosion problems critical to each group of energy systems (i.e. nuclear, solar, coal combustion and conversion, oil and gas recovery etc.) are summarized. Recommendations are made for basic fundamental research in direct support of the known corrosion problems in specific energy systems. Then the recommended research is further summarized according to generic topics which were identified as common to several kinds of energy systems.

28155 **High current resistance welding for capsule closure.** Kanne, W.R. Jr.; Kelker, J.W. Jr. (E.I. du Pont de Nemours and Co., Aiken, SC). *Welding Journal (Miami);* v(Nov 1980).

From 61. AWS annual meeting; Los Angeles, CA, USA (14 Apr 1980).

A resistance welding procedure has been developed for solid-state joining of aluminum caps and capsule bodies. This procedure is a special application of upset welding that provides reproducble, high strength welds requiring high welding current, special joint designs, and fixturing. Feasibility studies have also been made on welding other alloys such as tungsten, Haynes 25, TD nickel, and Type 304L stainless steel.

28156 **High temperature heat content and heat capacity of liquid cerium-copper alloys by levitation calorimetry.** Dokko, W. (Jet Propulsion Lab., Pasadena, CA); Bautista, R.G. *Metallurgical Transactions, [Section] B: Process Metallurgy;* **11**: 511-518(Sep 1980).

The electromagnetic method of heating was used to determine the heat contents of liquid-cerium-copper alloys over the complete range of alloy composition. The temperatures of the levitated samples were determined pyrometrically utilizing the normal spectral emissivity data measured in an earlier work. The heat capacity was derived from analytic expression for heat contents. The composition dependence of the heat capacity goes through a maximum at 67 at. % Cu. This behavior is ascribed to the effect of a Cu-Cu_2-type atomic clustering in the liquid phase.

28157 **Relation between mechanical properties and microstructure in CRE Type 308 weldments.** King, R.T.; Stiegler, J.O.; Goodwin, G.M. (Oak Ridge National Lab., TN). *Welding Research (Miami);* v(Jul 1974).

A shielded metal arc (SMA) Type 308 stainless steel pressure vessel test weld with the controlled residual elements (CRE) boron, titanium, and phosphorus was tensile tested and creep tested at temperatures to 650°C (1200°F). Improved ductility in tests lasting several thousands of hours, compared to that of standard welds, is associated with the absence of interphase separation. Systematic variations in microstructure and mechanical properties throughout the weld and in the heat-affected zone are due to thermal and mechanical cycling during the welding process. Anisotropic deformation,

that is related to local substructure and preferred crystallographic orientation, occurs.

3602 Ceramics, Cermets, And Refractories

REFER ALSO TO CITATION(S) 27991

28158 (INIS-SU—87, pp 98) **High-temperature electrical insulation for electrophysical installations.** Buzhinskii, O.I.; Lopatin, V.V.; Ushakov, V.Ya.; Chernenko, V.P. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii; Tomskij Politekhnicheskij Inst. (USSR)). 1981. (In Russian). Dep. NTIS (US Sales Only).

From 2. all-union conference on engineering problems of thermonuclear reactors; Leningrad, USSR (23 Jun 1981).

28159 **Silicon-nitride and metal composite.** Huffsmith, S.A.; Landingham, R.L. (to Dept. of Energy). US Patent 4,293,619. 6 Oct 1981. Filed date 11 Jun 1979. vp.

PAT-APPL-047597.

A composite and a method for bonding the composite are described. The composite includes a ceramic portion of silicon nitride, a refractory metal portion and a layer of MOSI2 indirectly bonding the composite together. The method includes contacting the layer of MOSI2 with a surface of the silicon nitride and with a surface of the metal; heating the layer to a temperature below 1400° C.; and, simultaneously with the heating, compressing the layer such that the contacting is with a pressure of at least 30 mpa. This composite overcomes useful life problems in the fabrication of parts for a helical expander for use in power generation.

28160 **Self-diffusion of hydrogen in $H_{1.65}MoO_3$.** Taylor, R.E.; Crawford, M.M.S.; Gerstein, B.C. (Ames Lab., IA). *Journal of Catalysis;* **62**: 401-403(1980). Contract W-7405-ENG-82.

The compoud was prepared by hydrogen spillover. The diffusion coefficient was measured by the pulsed field gradient technique and found to be (7.9 +- 1.6) x 10^{-6} cm^2/s at 298°K. Results are compared with these for the hydrogen spillover process in Pt/$WO_3$and Pt/MoO_3. They show that the rate-determiing step in the reduction is the penetration of spilled-over hydrogen through the MoO_3 surface. (DLC)

28161 **Superconductivity of new ternary borides with the $LuRuB_2$-type structure.** Ku, H.C. (Univ. of California, San Diego, La Jolla); Shelton, R.N. *Materials Research Bulletin;* **15**: No. 10, 1441-1444(1980). Contract W-7405-ENG-82.

A new group of superconducting ternary borides has been found with the general formula MTB_2, where M is Sc, Y or Lu and T is Ru or Os. The superconducting transition temperatures range from 1.3K for $ScOsB_2$ to 10K for $LuRuB_2$. Additionaly, ismorphous compounds with M = Tb, Dy, Ho, Er or Tm order magnetically with critical temperatures in the range 2 to 46 K. The occurrence of superconductivity and magnetism in this new ternary boride structure is discussed with respect to analogous data in MT_4B_4 systems.

28162 **Imprinting of slip bands in mechanically deformed MgO crystals using lithium impurities.** Orera, V.M.; Chen, Y.; Abraham, M.M. (Oak Ridge National Lab., TN). *Philosophical Magazine, [Part] A: Defects and Mechanical Properties;* **41**: No. 3, 431-441(1980). Contract W-7405-ENG-26.

Lithium impurities in MgO can be used to imprint slip bands produced by plastic deformation. The imprinting is obtained by means of $[Li]^0$ defects (subtitutional Li^+ ions each with an adjacent O^- ion) which absorb light at 680 nm (1.8 eV). Slip bands are observed as discolored regions against the background of dark blue coloration due to these defects. The decoloration can be achieved by two different processes: either by oxidation at 1275 K of a deformed crystal, or by the reverse procedure - deformation of a previously oxidized crystal. The mechanisms involved in the decoloration are different; the former is due to ionic motion, and the latter is an electronic effect. Similar procedures involving surface indentation by sharp objects also result in decoloration patterns.

3604 Polymers And Plastics

REFER ALSO TO CITATION(S) 27697

28163 **(BDX—613-2704) Formation of 2-vinylpyridine polymer films in the gas-glow discharge.** Park, A.D. (Bendix Corp., Kansas City, MO (USA)). Nov 1981. Contract AC04-76DP00613. 19p. NTIS, PC A02/MF A01. Order Number DE82004571.

The polymerization of 2-vinylpyridine in an ac electric discharged plasma process produced highly crosslinked, pinhole-free polymer films. Because of the good dielectric properties, glow discharge polymerized films were formed to be used as thin-film insulators and dielectrics. The significance of glow discharge polymerization as a process for forming thin films is discussed.

3606 Other Materials

REFER ALSO TO CITATION(S) 27985

28164 **Raman spectroscopic investigation of the structure and crystallization of binary alkali germanate glasses.** Furukawa, T.; White, W.B. (Pennsylvania State Univ., University Park, PA). *Journal of Materials Science;* **15**: 1648-1662(1980).

Raman spectra have been measured on bulk GeO_2 glass and the alkali germanate glasses of composition $M_2O.xGeO_2$ where M = K, Na, Li, and x varies from 19 to 1, as well as on crystallized glasses. the low alkali content glasses ($x \geq 3$) retain a completely polymerized structure of germanium polyhedra. Addition of small amounts of alkali oxide to GeO_2 glass does not break the Ge-O-Ge bridging bonds and creates higher co-ordination of germanium atoms. Further addition of alkali oxide eventually breaks up some of the Ge-O-Ge bonds to create $Ge\text{-}O^-$ non-bridging oxygens. In the K- and Na-glasses a small number of non-bridging oxygens already exist at x = 4.5, while in the Li-glasses they do not exist even at x = 4. The structures of the low alkali content glasses start to disappear at x between 4 and 3 and they disappear almost completely at x = 2. At x between 2 and 1, glass structures become analogous to the silicate glass structures. At x = 2, the glass consists of disordered $(Ge_2O_5)n$ sheet-like structures and at x = 1 disordered $(GeO_3)n$ chain structures.

28165 **TEM observations on grain boundaries in sintered silicon.** Foll, H.; Ast, D. (Cornell Univ., Ithaca, NY). *Philosophical Magazine, [Part] A: Defects and Mechanical Properties;* **40**: No. 5, 589-610(1979).

Grain boundaries in silicon with a predetermined orientation have been prepared by the sintering of two single crystals. A combination of standard transmission electron microscopy and lattice imaging was used to investigate e structure of the boundaries produced. Low-angle grain boundaries on (100) and (111) planes, and twin boundaries on (111) planes are discussed in detail.

40 CHEMISTRY

4001 Analytical And Separations Chemistry

REFER ALSO TO CITATION(S) 27654, 27696, 27723, 27725, 27763, 27767, 27769, 27770, 27968, 28434, 28435, 28436, 28441, 28497, 28718, 28733

28166 (INIS-SU—57, pp 158-162) **X-ray fluorescence analysis of substance composition taking into account the matrix effect.** Varvaritsa, V.P.; Evseev, V.S.; Lavrent'ev, Yu.D.; Mamikonyan, S.V.; Rogozhin, V.F. 1980. (In Russian). Dep. NTIS (US Sales Only).

In Radiation techniques. Issue 19. Questions of nuclear science and techniques.

A method of X-ray radiometric analysis using a special target as an internal radiation standard, made of an element, having atomic number close to the analyzed one, is suggested. Experimental test of the method has been conducted on powder samples of

complex composition of tin-tungsten deposits. Processing of the results has been carried out by means of the derived formula for calculating concentration, and the data have been compared with the data of chemical and X-ray radiometric (by the method of spectral relations) analyses. It is shown that the results of X-ray radiometric determinations of tin by the method of spectral relations are essentially lowered (relative error up to 40%) as compared with the data of chemical analysis for samples with high WO_3 content. Comparison of X-ray radiometric determinations of tin by the derived formula with the data of chemical analysis has shown good convergence of the results.

28167 (INIS-SU—57, pp 162-171) **Estimation of errors of X-ray fluorescence analysis due to dynamic change of controlled medium properties.** Varvaritsa, V.P.; Mamikonyan, S.V.; Mel'ttser, L.V.; Filatov, V.I.; Yakovlev, V.I. 1980. (In Russian). Dep. NTIS (US Sales Only).

In Radiation techniques. Issue 19. Questions of nuclear science and techniques.

Errors are considered, occurring during the change of sample parameters (concentration of the analyzed element, density) during measuring by different methods: during X-ray fluorescence analysis (XFA) and during absorption X-ray radiometric analysis (ARRA). Investigations have been conducted, analyzing pulps directly in flotation baths of enrichment enterprises. It is shown, that the analysis errors, caused by change of parameters of the analyzed medium, lie within the range from tenth share of per cents up to several per cents. During XFA these errors are not essential, while during ARRA they essentially increase.

28168 (INIS-SU—57, pp 171-175) **X-ray fluorescence analysis of substance composition using two radiation sources of different energies.** Varvaritsa, V.P.; Martishchenko, L.G. 1980. (In Russian). Dep. NTIS (US Sales Only).

In Radiation techniques. Issue 19. Questions of nuclear science and techniques.

An X-ray radiometric method of determining substance composition, based on using two fluxes of primary radiation with energies above absorption edge of the determined element, is suggested. The method permits to decrease matrix effect and to obtain linear dependence between the measuring results and the determined value (concentration). The method has the following advantages: 1) increased accuracy during analyzing substances of complex composition; 2) absence of necessity to know beforehand composition of the analyzed element and its variations; 3) simplicity of choice of primary radiation energies; 4) simplicity of equipment realization; 5) possibility of graduating the equipment directly in concentration units. The suggested method has been tested during measuring Zn concentration in samples, containing S, Ba, Ca and polyethylene. ^{109}Cd and ^{238}Pu have been used as sources.

28169 (INIS-SU—57, pp 122-133) **Feasibility studies of neutron activation determination of gold in boreholes.** Burmistenko, Yu.N.; Matalygina, Zh.I.; Feoktistov, Yu.V.; Shpanov, A.P.; Shtan, A.S. 1980. (In Russian). Dep. NTIS (US Sales Only).

In Radiation techniques. Issue 19. Questions of nuclear science and techniques.

Theoretical and experimental evaluation of possibilities of solving the problem of neutron-activation determination of gold in boreholes and determination of conditions, necessary for its realization, is conducted. Optical time operation conditions are determined. Experimental evaluation of activation effects on the model of gold-bearing ore body crossed by the hole, is carried out. Rock activation is calculated from the view point of personnel safety during its succeeding treatment. It is shown, that using a pulse neutron source with 10^{16} neutr./pul. yield, and during the following registration of guided activity by semiconducting spectrometer, the limit of gold determination under hole conditions will make up less, than 0.3 g/t. Optimal holding time during gold determination under the conditions of holes constitutes 6 days. In 5 days after rock activation by a source with 10^{16} neutr./pul. yield it can be treated as non-radioactive material.

28170 (INIS-SU—57, pp 109-113) **Activation determination of silicon using ring type isotope Be(α,n) - neutron sources.** Nikolaenko, O.K.; Tolkachev, I.V.; Tyufyakov, N.D. 1980. (In Russian). Dep. NTIS (US Sales Only).

In Radiation techniques. Issue 19. Questions of nuclear science and techniques.

Peculiarities and possibilities of using neutron Be (α, n)-sources in the form of a hollow cylinder or half-cylinder for analysis on silicon, are considered. Calculation results of distribution of fast neutron flux density inside the sources of the mentioned configurations, are given. Experiments with ^{244}Cm-Be source, having $4x10^8$ neutr./s yield, are conducted for obtaining data on sensitivity of the analysis on silicon. The form of the source was half-cylindrical. The specimens were prepared of silicon dioxide. It is shown, that by means of a source with 10^9 neutr./s yield it is possible to determine Si content about 0.1% in specimens of 10 g mass with the error of 10 rel.% at 5 min analysis duration. Threshold of determination makes up about $2x10^{-3}$%. Immense contents of silicon (above 10%) can be determined with the error, less than 1 rel.%. The mentioned sources can be used for analysis of geological and metallurgic specimens.

28171 **(INP—1043/PL) Proceedings of the 11th national seminar on nuclear magnetic resonance and its applications.** (Institute of Nuclear Physics, Krakow (Poland)). 1979. 401p. (CONF-781292—). NTIS (US Sales Only), PC A18.

From 11. national seminar on nuclear magnetic resonance and its applications; Krakow, Poland (4 Dec 1978).

Individual items from the seminar were prepared separately for the data base. (GHT)

28172 (LA—8901-C, pp 23p, Session 8) **Survey of chemical and destructive analysis methods.** Oct 1981. NTIS, PC A99/MF A01.

From Advanced international training course on state systems of accounting for and control of nuclear materials; Santa Fe, NM, USA (27 Apr 1981).

Conventional methods of determining the concentration and isotopic composition of nuclear materials in the nuclear fuel cycle are reviewed. Problems of representative sampling and measurement uncertainties as they apply to conventional analytical problems are discussed. The purpose of this session is to enable participants to: (1) describe current chemical and mass-spectrometric methods typically used to characterize nuclear materials; (2) describe basic techniques for obtaining samples representative of bulk liquid, powder, or solid materials; and (3) identify principal sources of error for the above methods. 101 references.

28173 (LA—8901-C, pp 35p, Session 10) **Elements of nondestructive assay (NDA) technology.** Oct 1981. NTIS, PC A99/MF A01.

From Advanced international training course on state systems of accounting for and control of nuclear materials; Santa Fe, NM, USA (27 Apr 1981).

This session provides an introduction to nondestructive assay methods and instruments as they are applied to nuclear safeguards. The purpose of the sessions is to enable participants to: (1) discuss the general principles and major applications of NDA; (2) describe situations in which NDA is particularly useful for nuclear safeguards purposes; (3) distinguish between various passive and active gamma-ray and neutron NDA methods; (4) describe several NDA instruments that measure gamma rays, and identify assay situations particularly suited to gamma-ray techniques; (5) describe several NDA instruments that measure neutrons, and identify assay situations particularly suited to neutron techniques; (6) discuss the role of calorimetry in the NDA of plutonium-bearing materials; and (7) compare the advantages and disadvantages of various NDA methods for different types of nuclear materials.

28174 (LBL—12100, pp 67-68) **Use of fluorimetric techniques in trace analysis.** Klainer, S.M.; Perry, D.L.; Bowman, H.R.; Hirschfeld, T. Jul 1981. NTIS, PC A12/MF A01. Order Number DE82000804.

In Earth Sciences Division annual report 1980.

Research in this program at LBL has centered on the coprecipitation of uranium in calcium fluoride matrices and the experi-

mental parameters (such as calcination temperature and time, initial uranium concentration in solution, and interfering cations and anions) that affect the concomitant spectra of the samples. Instrumentation used to obtain the spectra has also been designed, interfaced, and its performance optimized. Detection limits, extent of the coprecipitation of the uranium in calcium fluoride, and selectivity of the technique have been studied, along with the application of the technique to actual uranium-containing groundwater samples. The coprecipitated uranium is then spectroscopically monitored by laser-induced fluorescence excitation (LIFE). The technique has detected uranium in solution at a concentration of 10^{-12}M, or 2.38 x 10^{-4} ppB. A delayed fluorescence technique has been employed to decrease prompt fluorescence interferences and general light scattering.

28175 (LBL—12100, pp 68-69) **Development of advanced mass spectrometric techniques.** Michel, M.; Keyes, W.R. Jul 1981. NTIS, PC A12/MF A01. Order Number DE82000804.

In Earth Sciences Division annual report 1980.

Preliminary work in using the isotope separator (a 5-foot radius mass spectrometer with 40 keV accelerating voltage) to determine the isotope ratios of naturally occurring uranium in groundwaters indicated considerable variation in the $^{238}U/^{235}U$ ratio of a natural standard from run to run. Since the variation in the $^{234}U/^{238}U$ ratio in groundwaters was to be the subject of a research program funded by the Office of Nuclear Waste Isolation, the variation obtained with the standard became of great concern. Because no previous work with individual ion counting had been done with this machine, a source of instrumental error was suspected. The present work was aimed at achieving the capability of measuring such isotope ratios in samples of uranium of 1 ng or less with a precision of approximately 2% in the ratio $^{234}U/^{238}U$.

28176 (PNL—4100-Pt.4, pp 93-94) **Environmental pollutant characterization by direct-inlet mass spectrometry.** Feb 1982. NTIS, PC A06/MF A01.

In Pacific Northwest Laboratory annual report for 1981 to the DOE Office of Energy Research. Part 4. Physical sciences.

The utility of direct-inlet mass spectrometry (DIMS) for the detection, characterization and monitoring of toxic airborne particulate pollutants is being experimentally determined. The dependence of the particle detection efficiency of the DIMS system on particle size was determined.

28177 (PNL—4100-Pt.4, pp 95-96) **Trace analysis by laser excitation.** Feb 1982. NTIS, PC A06/MF A01.

In Pacific Northwest Laboratory annual report for 1981 to the DOE Office of Energy Research. Part 4. Physical sciences.

Analyses of ultratrace levels of both inorganic and organic species are critical in the estimation of potential environmental and health effects. In the trace analysis by laser excitation program, laser techniques are developed and evaluated for laboratory and field use. During the past year, a resonance ionization technique was developed which should be extremely sensitive to all metallic elments. The application of this technique to a selected set of elements is described in the following report.

28178 **(RFP—3254) Recovery of uranium by extraction with polyurethane foam.** Korkisch, J.; Steffan, I.; Navratil, J.D. (Rockwell International Corp., Golden, CO (USA). Rocky Flats Plant; Vienna Univ. (Austria). Inst. for Analytical Chemistry). 1981. Contract AC04-76DP03533. 21p. (CONF-810899—1). NTIS, PC A02/MF A01. Order Number DE82003958.

From Actinide recovery symposium; New York, NY, USA (24 Aug 1981).

Since open cell polyurethane foam can act as a viscous organic polyether of moderate dielectric constant, it was used in this study for the extraction of μg-amounts of uranium in nitric acid and in the presence of salting-out agents such as ammonium, calcium and aluminum nitrates. In addition the extraction characteristics of thorium were investigated for the purpose of using the results for a possible separation of uranium from thorium. Thorium was found to be more strongly extracted than uranium in 0.1 M nitric acid solution containing varying concentrations of ammonium nitrates. Also the influence of other variables were investigated and tabulated. Some of these are: distribution coefficients of uranium in 0.1 M nitric acid which contains varying overall nitrate molarities of ammonium, calcium and aluminum nitrates; effect of acidity on the distribution coefficient of uranium at the overall nitrate molarity of 7M; effect of uranium concentration on the distribution coefficient of uranium in 0.1M nitric acid solutions of 7M overall nitrate concentration; effect of shaking time on the distribution coefficient of uranium in 0.1M nitric acid solutions of 7M over all nitrate concentration; effect of methanol and ethanol on the distribution coefficients of uranium in 20 ml mixtures of the alcohols with dilute nitric acid; distribution coefficients of uranium in 0.1M nitric acid solutions of 7M overall nitrate concentration using as extractant polyurethane foam impregnated with ethyl acetate; elution characteristics of uranium on a 0.5 g column of hexone impregnated polyurethane foam using 6M hydrochloric acid as the eluent. (ATT)

28179 **Multi-purpose low-level gamma spectrometer for single- and multi-parameter analysis of mixed gamma-emitters in environmental samples.** Bleck-Neuhaus, J.; Boikat, U.; Goedecke, R.; Herzer, W.; Wehrse, R. (Bremen Univ. (Germany, F.R.)). pp 31-40 of Methods of low-level counting and spectrometry. Proceedings Series. Vienna, Austria; IAEA (1981).

From IAEA international symposium on methods of low-level counting and spectrometry; Berlin, F.R. Germany (6 Apr 1981).

To analyse gamma-emitters at very low activities a four-detector system consisting of a 140-cm^3 Ge(Li), a 10 in. x 11 in. NaI guard-ring in two halves and a 3 in. x 3 in. plug-in NaI, was built in a 10-cm lead shielding. Each detector is connected to an ADC and a fast timing discriminator of its own. All the output signals are processed by a newly developed multiplexer. For each event in at least one of the detectors, a four-dimensional fast decision logic first discriminates between singles, coincident and invalid events. The coincident events are listed one by one without loss of information by the set of their respective ADC data-words on magnetic tape for subsequent computer-aided analysis of the coincidence structure of the gamma radiation. The singles are transmitted to a normal MCA memory yielding simultaneously - in the case of the Ge(Li) signals - the usual anti-Compton shielded gamma-spectrum. The system described was used for the ^{131}I analysis of algae and water samples, which were taken from between the estuary and the different subsidiary streams of the River Weser to determine the local and temporary distribution of the nuclide. The iodine content was between 5 and 50 $mBq.ltr^{-1}$ in the water and between 8 and 60 $Bq.kg^{-1}$ in dry material of the algae.

28180 **Radioassay of environmental samples by high-resolution gamma spectrometry and low-level beta counting.** Aziz, A.; Faruq, M.U.; Parveen, N. (Pakistan Inst. of Nuclear Science and Technology, Islamabad. Health Physics Div.). pp 221-228 of Methods of low-level counting and spectrometry. Proceedings Series. Vienna, Austria; IAEA (1981).

From IAEA international symposium on methods of low-level counting and spectrometry; Berlin, F.R. Germany (6 Apr 1981).

The paper describes some counting facilities available in low-level environmental surveillance laboratory at PINSTECH. Radioactive measurement techniques for the environmental media such as air-particulates, rain and surface waters, vegetables and other food items with low radioactivity concentration are described with particular reference to the lower limit of detection possible with the counting set-ups described. Air-particulates with complex gamma spectra were analyzed by a high-resolution Ge(Li) detector and a computer-based multichannel analyser from Canberra Industries. Other samples with simple spectra were analyzed by a NaI(Tl) scintillation detector. The better resolution of the Ge(Li) detector more than compensated for its lower efficiency with respect to the NaI(Tl) detector regarding analysis of complex gamma spectra. The background of the gamma spectrometry set-up was reduced by 8-cm lead shielding lined internally with 8-mm copper; the latter was used to remove the low-energy peak due to x-rays from lead. The system was capable of measuring gamma activity lower than 1.85 Bq, corresponding to a concentration of radioactivity in air of about 2.74 x 10^{-5} Bq/m^3 for a counting period of 100 min. The background of the beta set-up was reduced by aged lead

shielding and anticoincidence circuitry. The lowest beta activity measured by this counting set-up was about 9.31 x 10^{-7} Bq/m^3 in air for ^{90}Sr and 8.16x10^{-7} Bq/m^3 for ^{137}Cs. Beta counting of ^{137}Cs afforded a 100-fold increase in sensitivity over gamma counting. Low-level tritium in aqueous samples was measured by a Packard Model 3320 liquid scintillation spectrometer. The instrument has a low background due to cooling of the photomultipliers and coincidence technique. The minimum activity of tritium measured for a 50-min counting period ranged from 0.5 to 1.0x10^{-2} Bq/ml, corresponding to 50 to 100 tritium units (TU).

28181 Detection methods for trace amounts of plutonium. Peuser, P.; Gabelmann, H.; Lerch, M. (Mainz Univ. (Germany, F.R.). Inst. fuer Kernchemie). pp 257-262 of Methods of low-level counting and spectrometry. Proceedings Series. Vienna, Austria; IAEA (1981).

From IAEA international symposium on methods of low-level counting and spectrometry; Berlin, F.R. Germany (6 Apr 1981).

Various methods have been studied for determining trace amounts of plutonium in environmental samples. With an improved α-spectroscopic technique ^{239}Pu activities down to 10 fCi (approximately equal to 4.1x10^8 atoms) could be measured. The delayed fission neutron method and the fission-fragment track technique yielded detection limits for ^{239}Pu of 10 pCi (approximately equal to 4.1x10^{11} atoms) and 4 fCi (approximately equal to 1.6x10^8 atoms), respectively. A novel method using laser spectroscopy is being developed for which an extreme sensitivity of $<10^6$ plutonium atoms in the sample, together with high isotopic resolution, is expected. In this method the fluorescence radiation after resonant excitation is measured from ions stored in a high-frequency quadrupole trap in order to extend their interaction time with the laser light. The experimental arrangement is described and first results are given.

28182 Surface barrier detectors for the determination of ^{99}Tc by beta spectrometry. Holm, E.; Rioseco, J.; Persson, R.B.R. (Lund Univ. (Sweden). Radiofysiska Institutionen). pp 277-281 of Methods of low-level counting and spectrometry. Proceedings Series. Vienna, Austria; IAEA (1981).

From IAEA international symposium on methods of low-level counting and spectrometry; Berlin, F.R. Germany (6 Apr 1981).

A method for the determination of ^{99}Tc in different samples by means of beta spectrometry with silicon surface barrier detectors is described. Technetium is radiochemically separated by extraction with TOA (Trioctyl amine)-xylene from sulfuric acid medium and electro-deposited on to stainless steel from sodium hydroxide solution. As a radiochemical yield determinant, ^{99}Tc/sup m/ freshly separated from ^{99}Mo is used; ^{99}Tc/sup m/ is quantitatively and qualitatively determined by the monoenergetic conversion electrons emitted. After decay of ^{99}Tc/sup m/, ^{99}Tc is counted by the same detector giving theoretically a least detectable activity of 10 mBq in 60,000 s counting time.

28183 Proportional counting techniques for routine tritium analyses at environmental levels. Bowman, W.W.; Hughes, M.B. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). pp 353-358 of Methods of low-level counting and spectrometry. Proceedings Series. Vienna, Austria; IAEA (1981).

From IAEA international symposium on methods of low-level counting and spectrometry; Berlin, F.R. Germany (6 Apr 1981).

Techniques and procedures were developed to analyze routinely samples for tritium as part of research and monitoring programmes on the transport of radionuclides released from the Savannah River Plant site. Because tritium concentrations in the environment are low, trace analysis methods were developed. The primary analysis technique involves converting aqueous samples to hydrogen gas which is mixed with propane and assayed in proportional counters. Counter background is reduced by massive shielding, anticoincidence gating with plastic scintillators, and pulse-shape discrimination. The overall sensitivity for tritium is 0.02 pCi/g water with a demonstrated precision of 6.3% at 1 pCi/g water.

28184 Routine performance of a new multi-counter system for high-precision ^{14}C dating. Schoch, H.; Muennich, K.O. (Heidelberg Univ. (Germany, F.R.)). pp 361-370 of Methods of low-level counting and spectrometry. Proceedings Series. Vienna, Austria; IAEA (1981).

From IAEA international symposium on methods of low-level counting and spectrometry; Berlin, F.R. Germany (6 Apr 1981).

A new ^{14}C detector system containing nine independently working CO_2 proportional counters is described. The counter system provides sufficient measuring capacity at a precision level of σ = +-1.5 permille (equivalent to +-12 years in age) requiring a counting time of about one week per sample. All counters are run with a common high voltage and stability is checked with a ^{226}Ra γ-source. The amount of CO_2 is 384 mmol (2 atmospheres pressure), chromatographically purified over charcoal. During this process radon is completely removed, the sample loss is negligible, and no detectable isotope fractionation occurs in the sample. The CO_2 sample size control is checked by an analytical balance to a precision better than +-0.1 permille. The modern carbon count-rate (54 counts/min) is sensitively checked by running samples of the Heidelberg sodium carbonate standard (giving a count-rate of about 10 times modern), by which the entire chemical sample procedure is checked. The background lies between 3 and 3.6 counts/min depending on the position of the counters within the anticoincidence shield. The systematic background variation primarily due to barometric-pressure-induced fluctuations of cosmic-ray intensity, is eliminated by a regression with the coincidence counting rate of the ^{14}C counters with the anticoincidence shield. Thus, the background does not significantly contribute to overall precision and reproducibility at the ^{14}C activity levels met in oceanography and in tree-ring calibration for whose applications the detection system was designed. A micro-computer (DEC PDP 11/63) is used for data aquisition. Data transfer to the computer memory goes via a DMA-Interface (Software: 4K stand-alone system; functions: timer, counters, protocol and system check).

28185 Small gas proportional counters for the ^{14}C measurement of very small samples. Sayre, E.V.; Harbottle, G.; Stoenner, R.W. (Brookhaven National Lab., Upton, NY (USA)); Otlet, R.L.; Evans, G.V. (UKAEA Atomic Energy Research Establishment, Harwell). pp 393-407 of Methods of low-level counting and spectrometry. Proceedings Series. Vienna, Austria; IAEA (1981).

From IAEA international symposium on methods of low-level counting and spectrometry; Berlin, F.R. Germany (6 Apr 1981).

There are many research areas in which the determination of ^{14}C/^{12}C ratios would yield results of substantial scientific and/or practical value if the ratio could be measured in very small quantities of carbon. These include archaeology, oceanography, climatology, glaciology, environmental studies, and authentication of museum objects. Two recent developments permit this goal to be obtained: the first is the mass-spectrometric separation of ^{14}C and ^{12}C ions, followed by counting of the ^{14}C; while the second is the extension of conventional proportional counter operation, using CO_2 as counting gas, to very small counters and samples. Although the second method is slow (months of counting time are required for 10 mg carbon) it does not require operator intervention and many samples may be counted simultaneously. Also, it costs only a fraction of the capital expense of an accelerator installation. In this paper the development, construction and operation of suitable-small counters are described, and results of three actual dating studies involving milligram-scale carbon samples are given. None of these could have been carried out if conventional, grams-sized samples had been needed. New installations, based on the use of these counters, are under construction or in the planning stages. These are located at Brookhaven Laboratory, the National Bureau of Standards (USA) and Harwell (UK). The Harwell installation, which is in advanced stages of construction, is described in outline. The main significance of the small-counter method is that, although it will not suffice to measure the smallest (much less than 10 mg) or oldest samples, it will permit existing radiocarbon laboratories to extend their capability considerably, in the direction of smaller samples, at modest expense.

28186 Standardization of low-level beta-emitter solutions by using the liquid-scintillation triple-to-double coincidence ratio (TDCR) method. Pochwalski, K.; Broda, R.; Radoszewski, T.; Zelazny, P. (Institute of Nuclear Research, Warsaw (Poland)). pp 487-496 of Methods of low-level counting and spectrometry. Proceedings Series. Vienna, Austria; IAEA (1981).

From IAEA international symposium on methods of low-level counting and spectrometry; Berlin, F.R. Germany (6 Apr 1981).

A precise instrument and method for experimental determination of the absolute disintegration rate of radioactive solutions of beta emitters by liquid-scintillation counting is described. The instrument includes a triple scintillation coincidence detector and double output counting system. The method is based on the extrapolation of counting rate to unity of the triple-to double coincidence ratio (TDCR). Examples of application of the method to ^{3}H, ^{63}Ni, ^{45}Ca, and ^{14}C are given. The advantages of applying the TDCR method to low-level counting are shown.

28187 Large-volume liquid-scintillation counting of environmental ^{14}C (using the CO_2 absorption technique) and ^{3}H in water. Eichinger, L.; Rauert, W. (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H. Muenchen, Neuherberg (Germany, F.R.). Inst. fuer Radiohydrometrie). pp 497-510 of Methods of low-level counting and spectrometry. Proceedings Series. Vienna, Austria; IAEA (1981).

From IAEA international symposium on methods of low-level counting and spectrometry; Berlin, F.R. Germany (6 Apr 1981).

On the basis of a known analysis method for ^{14}C-labelled compounds a simple, rapid technique was developed to measure low concentrations of environmental ^{14}C. A sample in the form of CO_2 containing 2, 3 or 5.3 g carbon is chemically bound in an absorbent-scintillator solution, filled in a quartz cuvette (up to 170 cm^3 volume) and measured in a large-volume liquid-scintillation counter for 500-1000 min. The net count-rates for 100%-modern carbon samples containing 6.1 pCi ^{14}C/g carbon are 18, 27 and 42 counts/min and the experimental detection limit (97% confidence level) for ^{14}C lies between 3 and 1.5%-modern carbon. This might meet the requirements of many hydrogeological investigations. When measuring in a usual liquid-scintillation counter, using 24-cm^3 glass vials with 0.8 g absorbed carbon, an experimental detection limit of 9%-modern carbon is obtained, with a standard net count-rate of 5 counts/min. For ^{3}H in water the detection limit of large-volume liquid-scintillation counting is about 5 TU (16 pCi/ltr) with a calibration factor of 12 TU per cpm (counts/min). Spectral analysis of the liquid-scintillation background in the IfR measuring laboratory and a mine (shielding: about 60 m water equivalent) served to discover the optimum discriminator settings for measurement and to evaluate the possibility of background reduction.

28188 Performance of a mass spectrometer for determining low tritium levels from $^{3}He/^{4}He$ measurements. Lynch, M.C.F.; Kay, D.J. (VG Isotopes Ltd., Winsford, Cheshire, United Kingdom). pp 511-523 of Methods of low-level counting and spectrometry. Proceedings Series. Vienna, Austria; IAEA (1981).

From IAEA international symposium on methods of low-level counting and spectrometry; Berlin, F.R. Germany (6 Apr 1981).

The Micromass 3000 mass spectrometer is based on Clarke's $^{3}He/^{4}He$ instrument of McMaster University. The principal special features of the MM3000 are: (i) The double collector system, which uses an electron multiplier for the small $^{3}He^{+}$ ion beams and a conventional Faraday detector for $^{4}He^{+}$; (ii) The high sensitivity ion source; and (iii) The low-volume analyser tube employing static vacuum techniques. The sensitivity, resolution and background of the system are designed to permit measurement of ^{3}He and ^{4}He levels of the order of 10^{-12} cm^3 STP and 10^{-6} cm^3 STP, respectively, with a precision of 0.5%, although smaller quantities are detectable. The inherent resolution of the instrument is well in excess of 2000, but a resolution of 600 to 1000 is normally used for the $^{3}He^{+}$ collector as this is sufficient to separate $^{3}He^{+}$ from any interfering HD^{+} or H^{+}_{3} ions. At this resolution 900 ions per second of $^{3}He^{+}$ ions are obtained from 10^{-12} cm^3 STP of ^{3}He. This is the size of ^{3}He samples obtained from water samples containing tritium at levels around 200 tritium units (1 tritium unit (TU) = $IT/10^{18}$ H). At lower tritium levels the $^{3}He^{+}$ signal is correspondingly reduced, but the same techniques (described below) allow signals from 1-TU samples (5 ions/s) to be measured with good precision. The limit of detection is reached with quantities of ^{3}He in the region of 10^{-15} cm^3 STP and tritium levels of around 0.1 TU.

28189 Static $^{3}He/^{4}He$ gas mass spectrometer for low-level tritium concentration measurements. Halverson, J.E. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.); Herzog, L.F. II (Nuclide Corp., State College, PA (USA)). pp 525-533 of Methods of low-level counting and spectrometry. Proceedings Series. Vienna, Austria; IAEA (1981).

From IAEA international symposium on methods of low-level counting and spectrometry; Berlin, F.R. Germany (6 Apr 1981).

A dual-collector static gas mass spectrometer designed specifically for measuring ^{3}He and ^{4}He was constructed. This instrument will provide a very sensitive means of measuring tritium concentrations, from environmental samples by determining the concentration of ^{3}He, the decay product of tritium. The tritium sample is collected in or converted to an aqueous form, degassed, and stored in a sealed container for at least two weeks to allow ^{3}He to accumulate. The sensitivity is a function of the ^{3}He accumulation "wait" time. For samples stored for one month the predicted sample sensitivity based on the measured source sensitivity is 0.02 pCi/g (tritium in water) for a 3-g sample.

28190 Separation and alpha spectrometry of thorium and uranium from ground-level aerosols. Kolb, W.A.; Krupa, R.J. (Physikalisch-Technische Bundesanstalt, Braunschweig (Germany, F.R.)). pp 229-237 of Methods of low-level counting and spectrometry. Proceedings of an international symposium organized by the IAEA and held in Berlin (West), 6-10 April 1981. Vienna, Austria; IAEA (1981).

From IAEA international symposium on methods of low-level counting and spectrometry; Berlin, F.R. Germany (6 Apr 1981).

A rapid and effective method for investigating long-lived natural radionuclides in aerosols has been developed which allows ^{238}U, ^{235}U, ^{234}U, ^{232}Th, ^{230}Th and ^{228}Th to be measured. The chemical procedure consists of four steps: (i) Thermal mineralization of the sample at 450°C; (ii) Dissolution of the ash, which removes SiO_2 and converts Th to Th^{4+} and U to UO_2^{2+}; (iii) Separation of pure Th and U from other elements by ionic exchange on to anionite resin; and (iv) Melting with $NaHSO_4$, which protects U, and especially Th, from hydrolysis and other redox transformations. Long-term storage is possible. The electrodeposition of Th and U for alpha spectrometry is described and some problems related to alpha counting and data evaluation are discussed. The accuracy of the method is about +-10% and the overall efficiency about 18%.

4002 Inorganic And Physical Chemistry

REFER ALSO TO CITATION(S) 27686, 27738, 27793

28191 (RFP—3096) Reaction of oxygen with plutonium hydride. Stakebake, J.L. (Rockwell International Corp., Golden, CO (USA). Rocky Flats Plant). 12 Nov 1981. Contract AC04-76DP03533. 26p. NTIS, PC A03/MF A01. Order Number DE82002096.

Kinetics for the reaction of oxygen with plutonium hydride have been measured in 10 torr of oxygen and over a temperature range of 90 to 360°C. The initial reaction forms a protective oxide film. A secondary linear reaction occurs after formation of the protective film. Most of the data was obtained usng a plutonium-1 wt % gallium alloy to form $PuH_{2.0}$. Some information ispresented on the oxidation of $PuH_{2.7}$ prepared from unalloyed plutonium.

28192 Isopiestic studies of aqueous solutions at elevated temperatures. 5. $SrCl_2$ and $BaCl_2$. Holmes, H.F.; Mesmer, R.E. (Oak Ridge National Lab., TN (USA)). *Journal of Chemical Thermodynamics;* **13**: No. 11, 1025-1033(Nov 1981).

Isopiestic measurements have been made on $SrCl_2$(aq) and $BaCl_2$(aq) over the temperature range 382.96 to 473.61 K with NaCl(aq) as the reference solution for the calculation of osmotic coefficients. The molalities corresponded to NaCl(aq) molalities ranging from 0.6 to 6.5 mol kg^{-1}. An ion-interaction model was fitted to the osmotic coefficients of $SrCl_2$(aq) and $BaCl_2$(aq) with a standard deviation of fit (in the osmotic coefficient) ranging from 0.0007 to 0.0048. Parameters derived from the fit were used to calculate the activity coefficients. The osmotic and activity coefficients decrease with increasing temperature and become less dependent on molality. Previous isopiestic results between 318 and 394 K agree with the present study. Activity coefficients from electrochemical measurements between 283.15 and 343.15 K are not consistent with the isopiestic results.

28193 **Isopiestic studies of aqueous solutions at elevated temperatures. 6. LiCl and CsCl.** Holmes, H.F.; Mesmer, R.E. (Oak Ridge National Lab., TN (USA)). *Journal of Chemical Thermodynamics;* **13**: No. 11, 1035-1046(Nov 1981).

Isopiestic measurements have been made for LiCl(aq) and CsCl(aq) over the temperature range 382.96 to 473.61 K. NcCl(aq) served as the reference electrolyte for the calculation of osmotic coefficients and the molalities ranged from about 0.6 to 6 mol kg^{-1}, for NaCl(aq). An ion-interaction model gave an excellent fit to the experimental osmotic coefficients with a standard error of fit ranging from 0.0004 to 0.0016 in the osmotic coefficient. Parameters obtained from the fit were used to calculate the activity coefficients. The osmotic and activity coefficients both decreased with increasing temperature over this temperature range. LiCl(aq) is somewhat unusual among the alkali-metal chlorides in that the osmotic (and activity) coefficient is much more dependent on molality at the higher molalities and there is no maximum between 273.15 and 373.15 K in the osmotic coefficient as a function of temperature. For both LiCl(aq) and CsCl(aq) there is an excellent correlation between the isopiestic results and the vapor pressures of Lindsay and Liu. Existing electrochemical results between 283.15 and 343.15 K are consistent with the calculated activity coefficients for CsCl(aq).

28194 **Electronic properties, structure and temperature-dependent composition of nickel deposited on rutile titanium dioxide (110) surfaces.** Kao, C.C.; Tsai, S.C.; Bahl, M.K.; Chung, Y.W. (Northwestern Univ., Evanston, IL). *Surface Science;* **95**: 1-14(1980).

Ultraviolet photoelectron spectroscopy (UPS), x-ray photoelectron spectroscopy (XPS), Auger electron spectroscopy (AES) and low energy electron diffraction (LEED) have been used to study electronic properties and the surface structure of the TiO_2(rutile)(110) surface and the Ni/TiO_2(110) interface. A sputter-cleaned TiO_2(110) surface shows a (1 x 1) LEED pattern after annealing at 400°C for 15 min and a (1 x 2) pattern after an extended annealing at 615°C. AES showed that the O(510 eV)/Ti(380 eV) peak ratio change was within 5% for these two surfaces. From the binding energy shift of the Ni 2p/sub 3/2/ peak and the kinetic energy shift of the Ni $L_3M_{2,3}M_{2,3}$ Auger peak as a function of Ni coverage, we measure a relaxation shift of 0.7 eV and a chemical shift of 0.75 eV of the Ni 2p/sub 3/2/ peak for bulk Ni relative to half a monolayer of deposited Ni on the TiO_2(110)-(1 x 1) surace. These indicated that Ni atoms at the Ni/TiO_2(110)-(1 x 1) interface are negatively charged and the amount of charge transferred is estimated to be 0.13 e^-/Ni atom. On the TiO_2(110)-(1 x 2) surface, the amount of charge transfer is roughly 0.07 e^-/Ni atom. Such a variation in the charge state of Ni may affect the CO chemisorption and hence its methanation activity. Nickel deposited on the TiO_2(110) surface diffuses into bulk TiO_2 at 300°C of higher. Annealing at 300°C for 5 min results in a (1 x 2) LEED pattern, indicating long-range ordering of the Ni overlayer on the TiO_2(110) surface.

28195 **Trans-effect in ruthenium and osmium nitroso complexes.** Sinitsyn, N.M. pp 93-108 of Transvliyanie v khimii koordinatsionnykh soedinenij. Moscow, USSR; Nauka (1979). (In Russian)

Presence of dynamic trans-effect and static trans-effect in ruthenium and osmium nitroso complexes is grounded on the basis of obtained experimental data on the synthesis of various classes of these complexes and on the results of their investigation by physicochemical methods in solutions and polycrystals as well as on the basis of complied data analysis. Series of dynamic trans-effect of ligands and of static trans-effect are derived. The nature of trans-effect on X-M-NO coordinate is discussed in connection with the specific nature of chemical bond of nitroso group in complexes studied. Dynamic trans-effect manifests itself in the directed action of trans-active ligand, L on the L-M-X coordinate, resulting in the increase of reactivity of X ligand, trans-positioned to it. Dynamic trans-effect is often caused by redistribution of electron density on σ- and π-bonds along the L-M-X coordinate that results in the change of kinetic and thermodynamic characteristics of X ligand substitution reaction.

28196 **Combined field and diffusion charging of aerosol particles in the continuum regime.** Liu, B.Y.H.; Kapadia, A. (Univ. of Minnesota, Minneapolis). *Journal of Aerosol Science;* **9**: 227-242(1978). Contract AS02-76EV01248.

The charging of aerosol particles by unipolar ions in an electric field has been studied theoretically by means of a numerical solution technique. The technique involves calculating the particle charging rate by solving the macroscopic ion diffusion equation in an electric field by relaxation and then integrating the particle charging rate to determine the particle charge as a function of charging time. Results are presented showing the dimensionless particle charge, γ, as a function of dimensionless time, tau, for various dimensionless electric fields, w. The study provides a rigorous solution to the problem of combined field and diffusion charging of aerosol particles in the continuum regime. Comparison of the theoretical results with the experimental data of Hewitt (1957) and those of Smith et al (1977) shows that there is good agreement between the theoretical and experimental results. The discrepancy between theory and experiment is of the same order of magnitude as the estimated uncertainties in the experiental data themselves. 20 references, 12 figures, 3 tables.

4003 Organic Chemistry

REFER ALSO TO CITATION(S) 27668, 27669, 27671, 27672, 27673, 27674, 27675, 27676, 27677, 27686, 28195, 28197

4005 Photochemistry

28197 **Comparison of the capacities of the perhydroxyl and the superoxide radicals to initiate chain oxidation of linoleic acid.** Gebicki, J.M. (Macquarie Univ., North Ryde, Australia); Bielski, B.H.J. *Journal of the American Chemical Society;* **103**: No. 23, 7020-7022(18 Nov 1981).

From P_i (P).

Since data are accumulating that seem to dispute the role of O_2^- as a potent agent of biological damage, a study of the previously ignored conjugate acid, the perhydroxyl radical (HO_2), a transient species always formed in the presence of O_2^- in H_2O, was undertaken. The results of the systematic studies of the reaction rates of HO_2/O_2^- with a number of biochemicals as a function of pH are tabulated. The data indicated that HO_2 reacts faster than O_2^- with all of the compounds, and the reaction conditions are such that its presence is always assured. The reaction of HO_2 with linoleic acid (a C_{18} unsaturated fatty acid with 2 double bonds) was studied in detail using HO_2 formed from O_2^- generated by photolysis of oxygenated alkaline ethanol solutions in a special apparatus previously described. The present work does not answer the question whether the oxidation of linoleic acid and probably other polyunsaturated fatty acids by HO_2 can lead to biological damage, but it can be assumed now that the most obvious sites for damage are the plasma and intracellular membranes. (BLM)

4006 Radiation Chemistry

REFER ALSO TO CITATION(S) 28425

28198 (PNL—4100-Pt.4, pp 35-38) **Energy transport.** Feb 1982. NTIS, PC A06/MF A01.

In Pacific Northwest Laboratory annual report for 1981 to the DOE Office of Energy Research. Part 4. Physical sciences.

The measurement of primary interaction cross sections and the incorporation of these data into Monte Carlo calculations provide detailed information about the initial spatial distribution of absorbed dose. Our theoretical energy transport studies have focused on the use of this information to predict the evolution of chemical species formed as a result of the energy deposition. This effort has led to a stochastic approach to diffusion kinetics that can account for the influence of track structure on the yield of free radicals in the radiolysis of water. Fluorescence studies with pulsed alpha particle and proton beams provided the first experimental test of our stochastic model of tract structure effects. Our experimental studies use time-resolved emission spectroscopy to investigate the mechanism of energy transport in nonpolar liquids. Studies of the concentration dependence of time-resolved emission from solutions of benzene in cyclohexane also show the importance of using low benzene concentrations to minimize the influence of benzene dimers on the emission kinetics.

4007 Radiochemistry And Nuclear Chemistry

REFER ALSO TO CITATION(S) 28172, 28607

28199 (INIS-mf—6626) Uranium complexing equilibrium in non-aqueous and combined environments. Paunescu, N. (Institutul de Fizica si Inginerie Nucleara, Bucharest (Romania)). 1979. 29p. (In Romanian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE81700694.

Thesis.

Influence of perchlorate, nitrate and chloride anions upon equilibria of UOsub(2)sup(2+) anion band through shifting from NOsub(3)sup(-) to Cl^-. Emphasis was placed on the hyperchrome effect which occurs when substituting an acetone solvent to the aqueous one and when anion concentration is raised. Influence of the ligand cation was studied upon the equilibria of complexing the uranyl salts in acetone. Quaternary ammonium salts behave identically to the lithium ones. Sequent stability constants of the uranylchloride compounds were determined. The method of reverse frontal chromatography was used to establish the seeming equilibrium constant of the ^{235}U-^{238}U heterogeneous isotope exchange reaction, in the U(IV)-U(VI)-NO_3 and U(IV)-U(VI)-Cl^- system. The seeming equilibrium constant of the isotope exchange reaction lineally varies with raising iron nitrate concentration in the eluent. Experiments were developed to enrich uranium's contents of U235 through band shift accompanied chemical and ion exchange. Uranium isotope separation cascades were calculated for a separation factor $\alpha = 1.0133$. Comparison between various methods for uranium isotope separation has proved that the ion and chemical exchange method has certain advantages over gaseous diffusion and centrifuging.

28200 (INIS-SU—38, pp 98-104) **Isothermal filtration of radioactive gas taking into account condensation and nonequilibrium adsorption.** Bondarenko, A.G.; Kozorezov, E.V.; Kudryashov, N.A. 1978. (In Russian). Dep. NTIS (US Sales Only).

In Experimental methods in nuclear physics. No. 3. Collection of scientific papers.

The system of differential equations is obtained and solved which describes radioactive gas filtration taking into account condensation and nonequilibrium adsorption. The system solution has been obtained on assumption that condensate motion rate in a gas phase differs from the main gas flow motion rate. At the coincidence of these rates no saturation change (condensate fall-out into the liquid phase) is observed. This is what differs the results of the study of those earlier obtained.

28201 (PNL—4100-Pt.1, pp 127) **Radioisotope customer list.** Burlison, J.S. Feb 1982. NTIS, PC A10/MF A01.

In Pacific Northwest Laboratory annual report for 1981 to the DOE Office of Energy Research. Part 1. Biomedical sciences.

The purpose of this program is to prepare and distribute the annual document entitled List of DOE Radioisotope Customers with Summary of Radioisotope Shipments. This document lists the FY 1980 commercial radioisotope production and distribution activities of DOE facilties.

28202 Cesium diuranate $Cs_2U_2O_7$: heat capacity (5 to 350 K) and thermodynamic functions to 350 K. A re-evaluation of the standard enthalpy of formation and the thermodynamics of (cesium + uranium + oxygen). O'Hare, P.A.G.; Flotow, H.E.; Hoekstra, H.R. (Argonne National Lab., IL (USA)). *Journal of Chemical Thermodynamics;* **13**: No. 11, 1075-1080(Nov 1981).

The low-temperature (5 to 350 K) heat capacity of a well-characterized sample of β-$Cs_2U_2O_7$ has been measured by adiabatic calorimetry. No anomalies were observed in the plot of heat capacity against temperature, the curve having the normal sigmoid shape. These measurements were used to calculate thermodynamic functions to 350 K. At T = 298.15 K results were obtained for the following and are presented: C°sub(p); S°(T); (H°(T)-H°(0)); (G°(T)-H°(0))/T. Because of recent critical re-evaluations of thermochemical quantities for UO_2Cl_2, the published value for $\Delta H°sub(f)(Cs_2U_2O_7, c, \beta, 298.15 K)$ has been revised to -(3220.2 +- 1.8)kJ mol^{-1}. A discussion of the thermodynamics of (cesium + uranium + oxygen) at high temperatures is included.

28203 Equilibrium hydrogen pressures in the Th-N-H system. Peterson, D.T.; Nelson, S.O. (Ames Lab., IA (USA)). *Journal of the Less-Common Metals;* **80**: No. 2, 221-226(Aug 1981).

The metal-rich corner of the Th-N-H system was studied by measuring the hydrogen equilibrium pressure at various compositions and at temperatures from 350 to 850°C. A ternary compound, ThNHsub(x), was found and characterized. ThNHsub(x) has an f.c.c. unit cell with $a_0 = 5.596$ +- 0.008 A. The enthalpy of formation was determined to be -16.3 +- 1.5 kcal $(mol\ H_2)^{-1}$.

28204 Absorption spectrophotometric study of $^{253}EsF_3$ and its decay products in the bulk-phase solid state. Ensor, D.D.; Peterson, J.R. (Tennessee Univ., Knoxville (USA). Dept. of Chemistry; Oak Ridge National Lab., TN (USA)); Haire, R.G.; Young, J.P. (Oak Ridge National Lab., TN (USA)). *Journal of Inorganic and Nuclear Chemistry;* **43**: No. 10, 2425-2427(1981).

Absorption spectrophotometry has been used to study $^{253}EsF_3$ and its decay products in the solid state. The absorption spectra of the daughter BkF_3 and granddaughter CfF_3 have been observed as a function of time. From previously published absorption spectra for BkF_3 and CfF_3, it is apparent the oxidation state of the metal ion remains trivalent. Studies of both the fine structure of the absorption spectra and X-ray powder diffraction data indicate the daughter and granddaughter compounds have local order corresponding to that of the high-temperature, LaF_3-type trigonal structure.

4008 Combustion, Pyrolysis, And High-temperature Chemistry

REFER ALSO TO CITATION(S) 27803, 27804, 27806

42 ENGINEERING

4202 Facilities And Equipment

REFER ALSO TO CITATION(S) 27969, 28288

28205 Vibration of a group of circular cylinders subjected to fluid flow. Chen, S. (Argonne National Lab., IL). pp 75-88 of Flow-induced vibration design guidelines. PVP: Volume 52. Chen, P.Y. (ed.). New York, NY; American Society of Mechanical Engineers ([nd]). Contract W-31-109-ENG-38.

Many structural and mechanical components consist of multiple circular cylinders, such as heat exchanger tubes and nuclear fuel bundles. These components are subjected to fluid flow. The fluid flow represents a source of energy that can induce and sustain vibration. In addition, the fluid moving with vibrating structures has an important effect on the dynamic characteristics of the structure. The dynamics of multiple circular cylinders in stationary fluid,

parallel flow and cross flow are reviewed and general design guides to avoid detrimental vibration and instability are presented.

28206 **(CEA-CONF—5723) Use of a scanning electron microscope for examining radioactive materials.** Kauffmann, Y.; Prouve, M. (CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France). Dept. de Metallurgie). May 1981. 10p. (In French). (CONF-8105128—2). NTIS (US Sales Only), PC A02/MF A01. Order Number DE81700700.

From Workshop on hot laboratories and remote handling; Karlsruche, F.R. Germany (21 May 1981).

The LAMA laboratory of the Grenoble Nuclear Research Center participates in studies carried out by research teams on fuels. Post-irradiation studies are performed on irradiated pins for research and development and safety programs. A scanning electron microscope was acquired for this purpose. This microscope had to fulfill certain criteria: it had to be sufficiently compact for it to be housed in a lead enclosure; it had to be capable of being adapted to operate with remote handling control. The modifications made to this microscope are briefly described together with the ancillary equipment of the cell. In parallel with these operations, an interconnection was realized enabling materials to be transferred between the various sampling and sample preparation cells and the microscope cell with a small transfer cask. After two years operating experience the microscope performance has been assessed satisfactory. The specific radioactivity of the samples themselves cannot be incriminated as the only cause of loss in resolution at magnifications greater than x 10,000.

28207 **(CEA-CONF—5729) Testing bench for spent fuel assemblies.** Van Craeynest, J.C.; Lhermenier, A.; Lebreton, S.; Toutin, M. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Technologie). May 1981. 11p. (In French). NTIS (US Sales Only), PC A02/MF A01. Order Number DE81700701.

From Workshop on hot laboratories and remote handling; Karlsruhe, Germany, F.R. (21 - 22 May 1981).

In the framework of a program for realizing pressurized water reactors, the D. Tech. SECS-SELECI of the French Atomic Energy Commission has transformed and adapted the shielded cell CLEMENTINE at SACLAY so that nondestructive and destructive tests could be carried out on complete 900 MW power reactor assemblies. Various operations have been carried out on both pins and assemblies since 1978. The work on the cell equipment has led to the development of a metrological test bench for examining irradiated fuels. This equipment includes a support for the assembly, a vertical girder and a displaceable tool-carrying trolley. This trolley, which moves along the Z-axis, is provided with tools for the metrological examinations associated with the displacement of the XY table, the assembly being remote controlled from a working zone situated in front of the cell. Visual examination of the four faces of the assembly is performed by displacing mirrors, which reflect the image of the object out of the cell onto a TV camera. Vertical measurements are made using optical sighting and comparing the lengths of objects with a graduated standard scale rigidly attached to the bench. Measurements made in a horizontal plane along a given Z-axis take the displacement of the sighting marks fixed to the mechanism into consideration. The displacement of this mechanism is a function of the number of pulses imparted to the system. A laser device is used to obtain the required pin spacing at various different heights in the assemblies.

28208 (CERN—81-07, pp 568) **Mapping of equipment with a microprocessor controlled X - Y moving state.** Bermond, M.; Fontaine, G.; Guglielmi, L.; Jaeger, J.J.; Szafran, S. (College de France, 75 - Paris. Lab. de Physique Corpusculaire). 17 Jul 1981. Dep. NTIS (US Sales Only).

From Conference on the application of microprocessors to high energy physics experiments; Geneva, Switzerland (4 May 1981).

28209 **(PB—81-855025) Remote viewing equipment. January 1975-November 1980 (citations from the NTIS data base). Report for Jan 1975-Nov 1980.** (New England Research Application Center, Storrs, CT (USA)). Dec 1980. 61p. NTIS PC N01/MF N01.

This bibliography covers the design, development and applications of remote viewing equipment. The equipment is used to inspect or view work areas that are exceptionally small, such as boreholes and the interior of steam pipes, or are hazardous, such as radiation environment. The abstracts cover sensors, manipulation, and viewing devices. Most of the applications pertain to the nuclear power industry. (Contains 51 citations, fully indexed and including a table of contents.)

28210 **(REPT—807) Helium turbo-expander with an alternator: large helium refrigerator-liquefier system.** Akiyama, Y. (Electrotechnical Lab., Ibaraki (Japan)). Jul 1980. 83p. (In several languages). NTIS, PC A05/MF A01.

The requirements for practical use of the large scale helium refrigerator system are considered. As a long continuous operation is required, the life time of the system should be approximately as long as that of other electrical machines. The refrigerator should be connected directly to the superconducting system by circulation of coolant (liquid or gaseous helium). In this case, an accident of the refrigerator system causes a fatal breakdown of the full system. The contamination in the circulating helium should be avoided. The efficiency of the refrigerator system should be as high as possible. The control method must be established so that the refrigerator can be operated for a long period by a few operators. A helium turbo-expander with externally pressurized helium gas bearings at the temperature of liquid nitrogen and an alternator as a brake was employed for the investigation.

28211 **Stresses in reinforced nozzle-cylinder attachments - a parameter study.** Bryson, J.W.; Johnson, W.G.; Bass, B.R. (Oak Ridge Natl Lab, Tenn). *Journal of Pressure Vessel Technology;* **50**: 51-65(1981). (CONF-810625—).

From ASME PVP conference; Denver, CO, USA (21 Jun 1981).

A parameter study was conducted on stresses in reinforced nozzle-to-cylinder attachments under internal pressure and external moment loadings as analyzed by the finite-element method. 25 models with nozzle-to-cylinder diameter ratios 0.08;less than equivalent to;d/D;less than equivalent to;0.50 and cylinder diameter-to-thickness ratios 10;less than equivalent to;D/T;less than equivalent to;100 were investigated. A three-dimensional finite element program, CORTES-SA, developed specifically for analyzing tee-joint configurations, was used. Each of the 25 models was analyzed for seven individually applied loadings: internal pressure, three mutually orthogonal moment loadings on the nozzle end, and three mutually orthogonal moment loadings on the cylinder end. 13 refs.

28212 **Prospects for generating 1-10 TPa pressures with a railgun.** Hawke, R.S.; Scudder, J.K. (Lawrence Livermore Lab., Livermore, CA). pp 979-982 of High pressure science and technology. Vodar, B.; Marteau, P. (eds.). Oxford, England; Pergamon Press (1980). Contract W-7405-ENG-48.

It has been demonstrated that a plasma arc can be accelerated along two current carrying parallel rails and used to accelerate a projectile. We have performed an extensive analysis and found the task of using a railgun to accelerate an impactor plate to velocities of 10 to 40 mm/μs to be feasible with contemporary technology. This range of impact velocities would enable shock pressures of 1 to 10 TPa to be generated for EOS research.

4203 Lasers

28213 **(NASA-CR—3428) Photoexcitation of lasers and chemical reactions for NASA missions: A theoretical study. Final report, 15 December 1976-17 December 1977.** Javan, A.; Guerra, M. (Laser Development Corp., Lexington, MA (USA)). May 1981. 50p. NTIS, PC A03/MF A01.

The possibility of obtaining CW laser oscillation by optical pumping in the infrared at an elevated gas pressure is reviewed. A specific example utilizing a mixture of CO and NO gases is included. The gas pressures considered are in excess of several atmospheres. Laser frequency tuning over a broad region becomes possible at such elevated gas pressures due to collisional broadening of the amplifying transitions. The prior-rate and surprisal analysis are applied to obtain detailed VV and VT rates for CO and NO mole-

cules and the transfer rates in a CO-NO gas mixture. The analysis is capable of giving temperature dependence of the rate constants. Computer estimates of the rates are presented for vibrational levels up to v 50. The results show that in the high-lying vibrational states the VV transfer rates with Delta nu 2 become appreciable.

28214 (PB—81-803868) Hydrogen fluoride and deuterium fluoride lasers. 1976-1980 (citations from the NTIS Data Base). Report for 1976-1980. (National Technical Information Service, Springfield, VA (USA)). Feb 1981. 198p. NTIS PC N01/MF N01.

The chemical reactions, molecular interactions, kinetics, and quantum mechanics in hydrogen fluoride and deuterium fluoride laser development are cited. Studies on excitation, optical equipment, gas mixtures, and window materials for these lasers are included. The spectral output, power, efficiency, applications, and performance of HF and DF 193 lasers are also covered. (This updated bibiography contains 193 citations, 33 of which are new enteries to the previous edition.)

28215 (PB—81-804023) Gallium arsenide lasers. 1964-1980 (citations from the NTIS Data Base). Report for 1964-1980. (National Technical Information Service, Springfield, VA (USA)). Feb 1981. 214p. NTIS PC N01/MF N01.

The report covers the design, development, and applications of gallium arsenide lasers. Studies on band theory, optical modulators, emission spectra, optical pumping, tuning, and efficiency of these lasers are included. (This updated bibliography contains 205 citations, 10 of which are new entries to the previous edition.)

28216 (PB—81-804031) X-ray lasers. 1969-1980 (citations from the NTIS Data Base). Report for 1969-1980. (National Technical Information Service, Springfield, VA (USA)). Feb 1981. 108p. NTIS PC N01/MF N01.

Citations of Federally-funded research on the theory, design, development, testing, and output of x-ray lasers are presented. Studies on sources, excitation, amplification, pumping, tuning, and optimization of these lasers are included. (This updated bibliography contains 101 citations, 8 of which are new entries to the previous edition.)

28217 (PB—81-804049) Ultraviolet lasers. 1966-1980 (citations from the NTIS Data Base). Report for 1966-1980. (National Technical Information Service, Springfield, VA (USA)). Feb 1981. 240p. NTIS PC N01/MF N01.

Government-sponsored research on the design, development, theory, and diagnostics of ultraviolet lasers is cited. Studies on molecular reactions, electron transitions, excitation, tuning, and optical pumping of these systems are covered. Materials lasing in these wavelengths and optical equipment for these lasers are also included. (This updated bibliography contains 233 citations, 24 of which are new entries to the previous edition.)

28218 (PB—81-804080) Carbon monoxide lasers. 1964-1980 (citations from the NTIS Data Base). Report for 1964-1980. (National Technical Information Service, Springfield, VA (USA)). Feb 1981. 233p. NTIS PC N01/MF N01.

The cited reports from a worldwide literature survey discuss the theory, design, performance, and calibration of various types of magnetometers. Only equipment studies are included; reports describing only applications or processing of data are generally excluded. (This updated bibliography contains 237 citations, 24 of which are new entries to the previous edition.)

28219 (PB—81-804098) Carbon monoxide lasers. 1978-1980 (citations from the Engineering Index Data Base). Report for 1978-1980. (National Technical Information Service, Springfield, VA (USA)). Feb 1981. 163p. NTIS PC N01/MF N01.

Worldwide research on carbon monoxide laser excitation, plasmas, development, molecular reactions, equipment, optics, transitions, and gas mixtures are cited. Studies on optical pumping, gas dynamics, chemical reactions, kinetics, and performance are covered. (This updated bibliography contains 156 citations, 14 of which are new entries to the previous edition.)

4204 Heat Transfer And Fluid Flow

REFER ALSO TO CITATION(S) 27636, 27958, 28019, 28039, 28205, 28805

28220 (INIS-SU—59, pp 35-42) Theory of vaporizing liquid stability on a heat transfer surface. Kokorev, L.S.; Ponomarev, V.A. 1980. (In Russian). Dep. NTIS (US Sales Only).

In Thermophysical problems in nuclear reactors. Issue 9. Experimental and calculation technique.

A method for approximate calculation of limiting values for vaporizing liquid superheating based on the equations of hydrodynamics and heat exchange is considered. Superheating values, calculated on the base of the obtained relations, for water at 0.1 MPa pressure, corresponding to the limiting state of dynamic stability, is equal to 110 deg C. It is concluded that this value is close to the temperature of the liquid spheroidal state, and it is essentially lower, than that for limiting superheating value determined on the base of the thermodynamic stability conditions.

28221 Finite element formulation for fluid-structure interaction in three-dimensional space. Kulak, R.F. (Argonne Natl Lab, Ill, USA). *Journal of Pressure Vessel Technology;* **103**: No. 2, 183-190(May 1981).

In this paper a development is presented for a three-dimensional hexahedral hydrodynamic finite-element. Using trilinear shape functions and assuming a constant pressure field in each element, simple relations were obtained for internal nodal forces. Because the formulation was based upon a rate approach it was applicable to problems involving large displacements. 10 refs.

28222 Hydrodynamics of a subsonic vapor jet in subcooled liquid. Simpson, M.E.; Chan, C.K. (Univ of Calif, Los Angeles). *Journal of Heat Transfer;* **15**: 27-34(1981). (CONF-810804—).

From 20. national heat transfer conference; Milwaukee, WI, USA (2 Aug 1981).

Small scale experiments were performed to investigate the condensation process and hydrodynamic pressure oscillations when steam was discharged into a subcooled water pool. The dynamic behavior of subsonic jets, differed from that of sonic jets. The interfacial motion of a subsonic jet was periodic, composed by three intervals: bubble growth, bubble translation, and bubble separation (necking). 15 refs.

28223 Analysis of Nusselt-type condensation on a vertical fluted surface. Panchal, C.B. (Argonne National Lab., IL); Bell, K.J. *Numerical Heat Transfer;* **3**: 357-371(1980).

This analysis considers isothermal flow and gravity-controlled condensation on a vertical fluted surface. In the initial part of the analysis, isothermal flow (drainage), which mainly occurs in the trough region of the flute, is considered, and velocity profiles, parametric dependences, etc. are studied. The simplified form of the equation of motion is solved by using the orthogonal collocation technique, which is particularly suitable for this kind of problem. In the second part, the condensation of a vapor on the fluted surface is studied with the basic assumptions required in Nusselt's analysis. The average Nusselt number for a given length of the tube is computed by solving the surface tension-governed equation of motion, while the Reynolds number is calculated by the method mentioned earlier. As a result, the Nusselt number as a function of Reynolds number can be computed for a given set of other parameters.

4205 Materials Testing

28224 (INIS-SU—57, pp 104-107) Choice of the material of check samples during radiation analysis of two-component coatings. Tumul'kan, A.D. 1980. (In Russian). Dep. NTIS (US Sales Only).

In Radiation techniques. Issue 19. Questions of nuclear science and techniques.

The problem of choice of the material of check samples during rational analysis of the composition of two-component galvanic coatings, sprayed on items, made of steel and alloys by means

of measuring transformers with ^{147}Pm, BDGS-1 source, which principle of operation is based on registration of back scattered β-radiation, is considered. A case is considered, when the surface density of the analyzed coating layer is less than the surface density of the saturation layer d<d sat. It is shown that the atomic number of the sample material in this case should be close to the atomic number of the coating material.

28225 **Acoustic emission analysis using pattern recognition.** Harrington, T.P.; Doctor, P.G. (Battelle Pacific Northwest Labs., Richland, WA). pp 1204-1207 of Fifth international conference on pattern recognition. New York, NY; Institute of Electrical and Electronics Engineers (1980). Contract EY-76-C-06-1830.

Three different pattern recognition techniques were applied to a data set consisting of acoustic emissions (AE) caused by crack growth and acoustic signals caused by extraneous noise sources. The purpose was to test the techniques for prescreening acoustic events and filtering out those that are produced by extraneous sources. The results were surprisingly good. Most of the noise waveforms used in this study cannot be distinguished from valid AE by visual examination; however, we were able to correctly classify 90% of the waveforms as either valid AE or noise using the least squares decision rule. Since the current applications of AE data in nondestructive evaluation rely primarily on counting acoustic events, the waveforms caused by noise in the environment must be filtered out to avoid misinterpretation. The results of this investigation have convinced us that pattern recognition concepts can be used to design such a filter.

4208 Electronic Circuits And Devices

REFER ALSO TO CITATION(S) 28974

28226 **(BDX—613-2701) Technical grade hydrofluoric acid etch-back. Final report.** Voltmann, R. (Bendix Corp., Kansas City, MO (USA)). Nov 1981. Contract AC04-76DP00613. 13p. NTIS, PC A02/MF A01. Order Number DE82004565.

Technical grade hydrofluoric acid (TG HF) was compared with analytical reagent grade hydrofluoric acid (AG HF) in the epoxy-glass etch-back process cycle of multilayer printed wiring board (PWB) fabrication. AG HF was in short supply and TG HF was evaluated as a substitute. The two acids were compared for depth of etch-back, completeness of glass fiber removal, and surface topography. Results show that TG HF could be used as an alternate material in this process without any changes in operating parameters.

28227 **(SAND—81-2540C) Comparison of IIR adaptive algorithms.** David, R.A.; Stearns, S.D. (Sandia National Labs., Albuquerque, NM (USA)). 1981. Contract AC04-76DP00789. 5p. (CONF-811139—3). NTIS, PC A02/MF A01. Order Number DE82003047.

From 15. annual asilomar conference on circuits, systems and computers; Monterey, CA, USA (9 Nov 1981).

The performance of different IIR adaptive algorithms are compared. Due to the non-quadratic nature of the performance surface and to potential instability, the IIR algorithms have design problems not encountered with FIR adaptive algorithms. We present simple two-pole adaptive algorithms whose performance, based on experimental results, appears to represent an improvement over the existing RLMS (Recursive Least Mean Squares) algorithm.

28228 **Component verification system.** Schroeder, D.D.; Hines, R.E. (Bendix Corp., Kansas City, MO). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Components, Hybrids, and Manufacturing Technology;* **3**: No. 3, 367-369(Sep 1980). Contract AC04-76DP00613.

Typical hybrid microcircuits (HMC's) manufactured at the Bendix Corporation, Kansas City, MO, contain 100 beam lead devices and gold ribbon crossovers. Verification for the presence of these applique components historically has been done manually by comparing a visual aid to the HMC. All HMC's were verified visually, a process requiring 4 to 5 min/HMC. Approximately 12% of the defects were missed. A system has been developed for automatically verifying the presence of beam lead devices and ribbon crossovers. The component verification system (CVS) includes a minicomputer-controlled X-Y stage which indexes the HMC below a vidicon camera. The camera is interfaced to the computer through a video digitizer. Bendix-developed software uses the equipment capabilities to magnify and project a 5.1-mm^2 area onto a 177.8-mm^2 screen with the image data points addressable in a 512 by 480 line matrix. The image analysis software determines component presence based on data point brightness. The CVS can verify beam lead device and crossover presences on a typical HMC in fewer than 30 s. The part identification of any missing part is printed as an aid to rework. The CVS has reduced the time needed for component verification and has improved verification accuracy.

4209 Waste Processing Plants And Equipment

REFER ALSO TO CITATION(S) 28134

4210 Combustion Systems

REFER ALSO TO CITATION(S) 27655, 27658, 27795, 27802, 27948, 28124, 28487, 28488, 28490, 28494

28229 **(DOE/ET/10423—1104, pp vp) Turbine materials performance in combustion gases from a coal-fired pressurized fluidized-bed combustor.** Jansson, S.A.; Nilsson, N.G.; Malm, B.O. (STAL-LAVAL Turbin AB, Finspong, Sweden). Sep 1981. NTIS, PC A07/MF A01.

In Fluidized-bed combustion 1000-hour test program. Volume IV. Engineering details and post-test inspections.

Turbine blade sections and a number of alloy specimens were exposed in a turbine materials cascade during the recent 1000 hour PFBC test at CURL, Leatherhead, England. The material temperatures were 770 to 780°C and the gas velocities over tested materials ranged from 180 to 520 m/s. Examination of the different components after the test showed no measurable erosive wear. However, oxide particles which according to their composition must have originated from steel surfaces in the system and most likely after the cyclones, were found to have impacted and become stuck in the coated blade sections. Proper system materials selection will minimize this exfoliation effect. Udimet 500 blade sections coated with FeCrAlY and CoCrAlY exhibited very limited corrosion. An uncoated Udimet 500 blade section showed >100 μm hot corrosion after 950 hours exposure at crevice locations. Other specimens of the same alloy had < 30 μm corrosion attack. Alloy 713 C was very little corroded. IN 671 showed severe hot corrosion after only 200 hours exposure. This attack was localized to the leading edge suggesting a strong erosion-corrosion interaction, even in this non-erosive environment. Although the total exposure times are still relatively short as compared with expected component lives, the combined results from the study suggest that erosion, corrosion, and deposition in the gas turbine will not be of serious concern in PFBC combined cycle systems.

28230 **Wood heating system design conflicts and possible resolutions.** Shelton, J. (Shelton Energy Research, Santa Fe, NM). pp 873-891 of Residential solid fuels: environmental impacts and solutions. Cooper, J.A.; Malek, D. (eds.). Beaverton, OR; Oregon Graduate Center (1982).

From 1981 international conference on residential solid fuels; Portland, OR, USA (1 Jun 1981).

Desirable performance characteristics in residential solid fuel heating systems sometimes are in conflict; a design which enhances one characteristic may be detrimental to another. In this paper some of the basic conflicts are explained and their solutions explored.

28231 **Fluidized bed combustion on the domestic scale.** Trivett, G.S.; Al-Taweel, A.M.; Bond, W.T.; MacKay, G.D.M. (Technical Univ. of Nova Scotia, Halifax). pp 912-923 of Residential solid fuels: environmental impacts and solutions. Cooper, J.A.; Malek, D. (eds.). Beaverton, OR; Oregon Graduate Center (1982).

From 1981 international conference on residential solid fuels; Portland, OR, USA (1 Jun 1981).

The design of a Fluidized Bed Combustor (FBC) for residential comfort heating is described. An FBC with maximum output of 100,000 Btu/hour was used to determine performance. Thermal efficiencies were determined with wood (66%) and coal (78%) as fuels. Wood yielded a lower emission rate (20 g/Kg) than coal (40 g/Kg). A mixture of wood and coal gave a higher emission rate (55 g/Kg) than either fuel.

28232 **Effect of catalytic combustion on creosote reduction, combustion efficiency, and pollution abatement for residential wood heaters.** Zimar, F.; VanDewoestine, R.V.; Allaire, R.A. (Corning Glass Works, NY). pp 924-940 of Residential solid fuels: environmental impacts and solutions. Cooper, J.A.; Malek, D. (eds.). Beaverton, OR; Oregon Graduate Center (1982).

From 1981 international conference on residential solid fuels; Portland, OR, USA (1 Jun 1981).

A catalytic combustor for wood stove smoke has been developed which reduces accumulation of creosote in flues and chimneys, improves stove efficiencies, and reduces air pollution. A gravimetric analytical procedure was devised to assess the effectiveness with which creosote was removed from wood stove flue gas by combustors of different cell densities and lengths. The 16 cell/in^2, 3" long, 5.66" diameter combustor appears to be the best compromise with regard to catalytic activity, pressure drop and cost. At high creosote inlet loading it removes 95% of the creosote and 85% at low inlet loading. Preliminary results of calorimeter room tests indicate that the combustion efficiency was increased 15% for a modified Riteway stove operating at low burning rate, precisely where it is needed the most. Preliminary results of gas chromatographic/mass spectrographic analyses of ice water cooled condensate show that the 3" 16 cell/in^2 combustor removed 76% of the POM and 90% of the non-POM organics from wood stove flue gas.

28233 **Pellet wood stokers: evaluation and testing of available systems.** Brandon, R.J.; Murray, D. pp 941-965 of Residential solid fuels: environmental impacts and solutions. Cooper, J.A.; Malek, D. (eds.). Beaverton, OR; Oregon Graduate Center (1982).

From 1981 international conference on residential solid fuels; Portland, OR, USA (1 Jun 1981).

Recent research conducted in Prince Edward Island under the Canada-P.E.I. Agreement on Renewable Energy Development indicated that a Will-Burt residential furnace equipped with a screw stoker burned wood pellet fuel cleanly and efficiently. A further test program was set up during the winter of 1980/81 to evaluate a number of residential coal stokers fired with wood pellet fuel. Eight units from Will-Burt, Stokermatic, Combo and PMC were evaluated. The objectives of the program were: (1) to confirm the performance of pellet stokers as observed in a 1979 to 1980 test program; (2) to observe and determine performance and operational differences between equipment presently available for coal firing which also can burn wood pellet fuel; (3) to determine both the technical options available to improve the performance of the modified coal stokers and also the potential for unit cost reduction. This paper reports on results from the test program to determine the thermal efficiency and emission performance. A stack loss method was used to determine thermal efficiency and a high volume sampling method determined the total particulate and condensable organic emissions of the units.

28234 **Home heating with wood chips.** Short, C.A. (Univ. of New Brunswick, Fredericton). pp 966-983 of Residential solid fuels: environmental impacts and solutions. Cooper, J.A.; Malek, D. (eds.). Beaverton, OR; Oregon Graduate Center (1982).

From 1981 international conference on residential solid fuels; Portland, OR, USA (1 Jun 1981).

An automatic, underfired, wood-chip stoker and a hot water boiler, both of Swedish design, were installed in a 107 m^2 (1152 ft^2) residence in early 1979. This heating system has been the only source of heat for space heating, domestic hot water and spot heating of an inground swimming pool since then, and operates year round for domestic hot water production as did the original oil fired boiler. The fuel used consists of a yard-run mixture of hardwoods and softwoods in the form of predominantly 1/4" to 1/2" chips specially produced for use in the stoker. The wood had been stored as 8 foot roundwood for at least 6 months prior to chipping. As burned, the chips had moisture contents varying from 8% to 56% (dry basis). System performance has been monitored daily and has been compared to that of the original oil fired system. Combustion efficiency is approximately 80% and is comparable to that of the oil fired boiler. Operating convenience, safety and reliability exceed that of a chunk-wood system and approach that of an oil fuelled system. However, care is required to control fuel quality in order to avoid possible introduction of airborne, pathogenic fungal spores to which certain individuals may be particularly sensitive.

28235 **Method for measuring heat output and efficiency on wood heating appliances and results from tests on ten woodstoves and fireplaces.** Sundstroem, L. (National Testing Inst., Boras, Sweden). pp 1038-1054 of Residential solid fuels: environmental impacts and solutions. Cooper, J.A.; Malek, D. (eds.). Beaverton, OR; Oregon Graduate Center (1982).

From 1981 international conference on residential solid fuels; Portland, OR, USA (1 Jun 1981).

A method for efficiency measurements on wood burning appliances has been developed. The method is a direct type, using a calorimetric room. Heat measurements are made on air which is circulated through the room. Two types of firing technique are used. Continuous firing with inputs of wood every 30 to 40 minutes and a test where only two large charges of wood are burnt. The tested stoves and fireplaces were chosen from different designs and representing an average of the Swedish market at the time. They are divided into four categories in this paper where the fireplace group has the lowest efficiencies. Efficient stoves generally had quite high heat output and efficiency. A large mass is associated with great heat storage capacity.

28236 **Measuring and improving the efficiency of large wood-fired furnaces impact on emissions and fuel use.** Roberts, J. (Puget Sound Air Pollution Control Agency, Seattle, WA); Austin, F.; Rossano, A.T.; Willenberg, J. pp 1089-1116 of Residential solid fuels: environmental impacts and solutions. Cooper, J.A.; Malek, D. (eds.). Beaverton, OR; Oregon Graduate Center (1982).

From 1981 international conference on residential solid fuels; Portland, OR, USA (1 Jun 1981).

The measurement of stack carbon dioxide and temperature provide a quick and low-cost way to determine furnace efficiency and identify furnaces that may have high emissions. Five nomographs are presented for rapid efficiency determinations of boilers burning wood with 10, 20, 30, 40, and 50% moisture. The thermal efficiencies of the larger wood-fired boilers are reported to range from 16 to 73%. The typical excess air was 248% from a total of 65 tests by Puget Sound Air Pollution Control Agency (PSAPCA), Washington State Department of Ecology (WDOE) and Bumstead-Woolford Co. There is a potential fuel savings for wood-fired boilers in Washington of 17.5% by reducing excess air to 50%. Wood furnaces that waste the most fuel also have the highest emissions which may include toxic organics. Improving efficiency is an attractive was to reduce emissions while cutting fuel costs on larger furnaces.

28237 **Thermal performance testing of residential solid fuel heaters.** Shelton, J.W. (Shelton Energy Research, Santa Fe, NM). pp 1117-1159 of Residential solid fuels: environmental impacts and solutions. Cooper, J.A.; Malek, D. (eds.). Beaverton, OR; Oregon Graduate Center (1982).

From 1981 international conference on residential solid fuels; Portland, OR, USA (1 Jun 1981).

There are at least three basic methods for measuring the thermal performance of residential solid fuel heating appliances - output calorimetry, various flue gas loss approaches and in-situ co-heating. Currently the most widely used approach for controlled-air appliances is an Orsat-analysis version of the stack loss method. This method is currently part of a proposed ASHRAE standard - ASHRAE 106P. However, ASHRAE 106P is increasingly controversial within the industry. The Orsat stack loss method applied to

residential solid fuel heaters involves many significant approximations. Extant experimental comparisons between the Orsat approach and room calorimetry (which is generally acknowledged to be the most accurate method) are inadequate for indicating the possible errors in the Orsat method over all relevant conditions. A second area of controversy is the fuel. ASHRAE 106P specifies firebrands (as in many UL standards). But firebrands, compared to normal fuel, are very unrealistic; they result in substantially different performance and distort rankings. In this paper these and other testing issues are discussed, and research needed to resolve some of them is proposed.

28238 **Design features and test experiences with domestic wood fired heaters in New Zealand.** Pullen, D.R. (Dept. of Health, Christchurch, New Zealand); Holden, R. pp 1166-1179 of Residential solid fuels: environmental impacts and solutions. Cooper, J.A.; Malek, D. (eds.). Beaverton, OR; Oregon Graduate Center (1982).

From 1981 international conference on residential solid fuels; Portland, OR, USA (1 Jun 1981).

The New Zealand Clean Air Act provides for the implementation of Clean Air Zones for the control of domestic smoke pollution. Domestic fuel options including wood types are discussed. Test procedure for judging the emission of domestic heaters is outlined, together with some test results. The features of wood burners available in New Zealand are illustrated with some suggested improvements.

4220 Underground Engineering

REFER ALSO TO CITATION(S) 27650

4230 Marine Engineering

28239 **How geotechnical engineers conquered the Beaufort Sea.** Schmertmann, J.H. *Offshore Services;* **14**: No. 6, 21-22, 24(Jun 1981).

The procedures and equipment used and problems encountered during exploratory drilling and sampling operations in the Beaufort Sea oil field north of Alaska and Canada are described. Soil samples were taken continuously to a depth of 40 ft into the sea floor at 6 possible offshore structure locations. In-situ cone penetration tests were performed to determine the frictional resistance of the seabed to penetration, and to evaluate soil conditions at each site. The effects of Arctic weather conditions and dangers from ice flows on these operations are discussed. (LCL)

4240 Pollution Control Equipment

REFER ALSO TO CITATION(S) 27959

28240 **(ITA—81-11-511) Greek market for air and water pollution control equipment. Foreign market survey report.** (ICAP Hellas S.A., Athens (Greece)). Aug 1981. 81p. NTIS PC $15.00/MF A01.

The market research was undertaken to study the present and potential US share of the market in Greece for air and water pollution control equipment; to examine growth trends in Greek end-user industries over the next few years; to identify specific product categories that offer the most promising export potential for US companies; and to provide basic data which will assist US suppliers in determining current and potential sales and marketing opportunities. The trade promotional and marketing techniques which are likely to succeed in Greece were also reviewed.

28241 **(PB—81-153819) Evaluation of the SCATPAC device.** (Environmental Protection Agency, Ann Arbor, MI (USA)). Jul 1973. 6p. NTIS, PC A02/MF A01.

The ECT Division was contacted by a representative of Cedar Rapids Engineering Company, of Cedar Rapids, Iowa, concerning their retrofit device for automobiles called SCATPAC. After being shown test results performed by Olson Laboratories which showed significant reductions of CO, HC, and NOx on a vehicle with the device installed (as compared to baseline), the ECTD agreed to perform testing of the device on an EPA owned vehicle.

28242 **(PB—81-153827) Evaluation of the hydro-catalyst corporation pre-combustion catalyst.** (Environmental Protection Agency, Ann Arbor, MI (USA)). Jul 1973. 7p. NTIS, PC A02/MF A01.

Hydro-Catalyst Corporation of Colts Neck, New Jersey, contacted the Environmental Protection Agency and requested an evaluation of their pre-combustion catalyst. Data was presented from Scott Laboratories compiled using a 1972 Cadillac Eldorado. The results of this testing illustrated good CO control with possible NOx reduction. An evaluation of this device was initiated by the Test and Evaluation Branch.

28243 **(PB—82-106782) Gas cleaning in industries with particular reference to electrostatic precipitators.** Dutt, Y. (Lurgi India Co. Pvt. Ltd., New Delhi). Nov 1975. 13p. NTIS, PC A02/MF A01.

In this paper the author intends to describe briefly the four major techniques of solid gas separation which have found wide application in industries. These are: (1) dedusting of gas by means of filtration media, (2) removing flue dust by centrifugal collectors, (3) dedusting of gas in washers and scrubbers, and (4) dust and mist removal by electrostatic separation. Out of the above four techniques, the last technique will be discussed in greater detail. The characteristics of the different dust separation equipment following these techniques differ widely in their collection efficiencies as well as investment, operating and maintenance cost. Although, each of these techniques has proved its suitability for certain applications, yet none is equally suitable for every dedusting duty. The different methods do, however, complement each other in a manner that an optimum solution for every industrial dedusting problem can be proposed.

43 PARTICLE ACCELERATORS

4301 Design, Development, And Operation

28244 (LYCEN—8102, pp C11.1-C11.18) **Heavy ion beams up to 40 MeV per nucleon with SARA.** Loiseaux, J.M. (Grenoble-1 Univ., 38 (France). Inst. des Sciences Nucleaires). [nd]. (In French). Dep. NTIS (US Sales Only).

From 6. biannual session of nuclear physics; Aussois, France (2 Feb 1981).

The accelerator system SARA (Grenoble) will deliver heavy ion beams with 40 to 10 MeV per nucleon for a mass-range of $4 < A < 50$. An ECR source will be installed in 1982 giving a mass-range of $4 < A < 100$ and rising the maximum energies for heavy ions around $A = 40$. SARA is made of two cyclotrons $K = 90 + K = 160$. The stripping foil is located between the two cyclotrons. Experimental equipments and transport beam lines already in use with the first cyclotron are ready (magnetic spectrometer, various scattering chambers, and an on-line isotopic separator). First experiments are planned in the Fall 1981.

4302 Beam Dynamics, Field Calculations, And Ion Optics

28245 **(UCID—19245) Diagnostics for the ATA beam propagation experiments.** Fessenden, T.J.; Atchison, W.L.; Barletta, W.A. (California Univ., Livermore (USA). Lawrence Livermore Lab.). Nov 1981. Contract W-7405-ENG-48. 26p. NTIS, PC A03/MF A01. Order Number DE82004741.

This report contains a discussion of the diagnostics required for the beam propagation experiment to be done with the ATA accelerator. Included are a list of the diagnostics needed; a description of the ATA experimental environment; the status of beam diagnostics available at Livermore including recent developments, and a prioritized list of accelerator and propagation diagnostics under consideration or in various stages of development.

4303 Auxiliaries And Components

REFER ALSO TO CITATION(S) 28244, 28282, 28284, 28285, 28286, 28287, 28290, 28297, 28299, 28302, 28303, 28312

28246 (BNL—51443-Vol.1, pp 303-329) **FNAL anti pp project.** Tollestrup, A.V. (Fermi National Lab., Batavia, IL). 1981. NTIS, PC A19/MF A01.

From Physics opportunities at ISABELLE summer workshop; Upton, NY, USA (20 Jul 1981).

The Tevatron I project at Fermilab was approved and funded in FY 1981. This project calls for construction of a anti pp source capable of producing a luminosity of 10^{30} at center of mass energies of the order of 2 TeV or 3 ergs. In addition, provision was made for two experimental areas; one at BO and the second at DO. A large detector is being constructed as a Laboratory facility at BO, and a workshop was held for the DO area where a number of groups presented a wide range of proposals. The time schedule for this facility is as follows: (1) finish Saver installation during the period of June to December 1982; (2) commission the Saver starting from CY 1983; (3) construction of the assembly hall and collision hall from the fall of 1981 to the summer of 1983; (4) construction of the Source starting in 1982 and finishing in 1984; (5) detector construction from the present through 1984; and (6) commissioning the Source starting in the summer of 1984. The schedule for the construction of DO is still under discussion. In addition, studies have recently shown that it should be possible to bypass the main ring around the collision hall. The cost and the impact of this option on the program is being studied. This report discusses the status of the Source, the collision hall, and the detector, and compares the potential for colliding beam physics at the Tevatron with that of ISABELLE.

28247 (BNL—51443(Vol.2), pp 439-442) **Single photon production in pp and anti pp at ISABELLE energies.** Benary, O. (Tel-Aviv Univ., Israel). 1981. NTIS, PC A18/MF A01.

From Physics opportunities at ISABELLE summer workshop; Upton, NY, USA (20 Jul 1981).

In this note we give estimates of the ratio for production of prompt photons to π^0's at ISABELLE energies, within the QCD framework (in the leading log approximation), as part of a more extensive study. We calculate the contribution to prompt γ production of the hard scattering processes and we also include bremsstrahlung from final state quarks.

28248 (BNL—51443(Vol.2), pp 448-473) **Report of Z^0, W^{+-} and γ working group.** Chen, M. (Massachusetts Inst. of Tech., Cambridge); Marciano, W.; Matsuda, T.; Paige, F.; Protopopescu, S.; Schildknecht, D.; Warnock, J. 1981. NTIS, PC A18/MF A01.

From Physics opportunities at ISABELLE summer workshop; Upton, NY, USA (20 Jul 1981).

ISA which will presumably come into operation in 1986 will give us an opportunity to search for new particles at the highest energy ($\sqrt{s}$ = 700 GeV) with a high luminosity of the order of 2 x 10^{31} cm^{-2}/sec. With the booster installed and with additional superconductive low-β quadrupoles closer to the intersection region at the later stage, the luminosity can be further increased to 10^{33} cm^{-2}/sec. Assuming an integrated luminosity of 1 x 10^{39} cm^{-2} for the first year and 10^{40} cm^{-2}/year with the booster, the following physics could result: 1) Z^0, W^{+-} production and the leptonic decays, 2) heavy sequential leptons, 3) search for new neutral high mass leptons, 4) new quarks and onium, 5) multiple muon events, 6) lifetime of long-lived particles, and 7) high mass Z^0 and W^{+-}. (GHT)

28249 (BNL—51443-Vol.3, pp 843-859) **Review of the experimental areas at CERN colliders.** Kantardjian, G. (European Organization of Nuclear Research, Geneva, Switzerland). 1981. NTIS, PC A16/MF A01.

From Physics opportunities at ISABELLE summer workshop; Upton, NY, USA (20 Jul 1981).

This note is an attempt to give an overall picture of experimental areas for the various CERN colliders: (1) ISR with a long experience on proton-proton colliding beams but which had also successes with other particles such as deuterons, alphas and very recently antiprotons; (2) SPS which is just now operating as a proton-antiproton collider; and (3) LEP, an electron-positron storage ring project, which the construction is expected to start very soon.

28250 (BNL—51443-Vol.3, pp 860-867) **Experimental area for the FNAL collider detector facility.** Theriot, D. (Fermilab, Batavia, IL). 1981. NTIS, PC A16/MF A01.

From Physics opportunities at ISABELLE summer workshop; Upton, NY, USA (20 Jul 1981).

The Fermilab Collider Detector Facility is a Fermilab-based consortium of national laboratories and universities from the United States, Japan and Italy currently engaged in the design of a general purpose detector to be used in anti pp collisions at 2000 GeV in the center of mass at the Fermilab Tevatron accelerator. The detector uses a 1.5 T superconducting solenoid, 3.0 m in diameter, 5.0 m long for a central magnet. This is filled with a cylindrical drift chamber and surrounded by electromagnetic calorimeters, hadronic calorimeters, and muon detection. A brief overview is given about the CDF detector but concentrates on the experimental area itself and the interaction of the CDF detector and the experimental area.

28251 (BNL—51443-Vol.3, pp 868-879) **Experimental areas: the PEP experience.** Nemethy, P. (Lawrence Berkeley Lab., CA). 1981. NTIS, PC A16/MF A01.

From Physics opportunities at ISABELLE summer workshop; Upton, NY, USA (20 Jul 1981).

A before and after look is taken at the PEP interaction regions. The experimental areas were designed before the submission of proposals and the approval of experiments. The design started from the experimental ideas of several summer studies. Although the experiments finally approved did not much resemble the summer study ones, the fit of the experimental halls to the experimental program turned out to be surprisingly good.

28252 (BNL—51443-Vol.3, pp 884-903) **Hadron calorimetry at ISABELLE.** Gordon, H.A.; Stumer, I.; Benary, O. 1981. NTIS, PC A16/MF A01.

From Physics opportunities at ISABELLE summer workshop; Upton, NY, USA (20 Jul 1981).

At very high energies, calorimetric methods have become increasingly more essential for measuring hadronic energy. We present here a study of the capabilities of calorimetry at $\sqrt{s}$ = 800 GeV at 90°. The rising multiplicity and complexity of the new physics can be easily exemplified by the event in Table I where a pair of t anti t quarks are produced at $\sqrt{s}$ = 800 GeV in a pp interaction. Each outcoming quark has a p/sub perpendicular/ = 100 GeV and emerges at y = 0. We are using for this study a QCD Monte Carlo program written by F. Paige and S. Protopopescu. The two beam fragments will be contained mostly in the beam pipes, but a non-negligible fraction of their particles will contaminate the physical measurements even at 90°. In the second section we describe our idealized-realistic detector and the showers' parameterization. In the third section we try to identify jets by calorimetry; e.g., mass, width. The fourth section deals with a real problem: can one select Z^0 events, when Z^0 decays into two hadronic jets amid the much higher background of two back-to-back jets produced at $\sqrt{s}$ = 800 GeV.

28253 (BNL—51443-Vol.3, pp 904-909) **Simple calorimetric triggers for Phase I operation.** Smith, S.D.; Gordon, H. 1981. NTIS, PC A16/MF A01.

From Physics opportunities at ISABELLE summer workshop; Upton, NY, USA (20 Jul 1981).

The usefulness of various analog calorimeter sums are evaluated as triggers in Phase I. In particular, discrimination of the effects of multiple minimum bias events within the same RF bucket are a concern. Here, minimum bias events are defined as those interactions comprising the bulk of the 50 mb total cross section which do not have high transverse momentum jet structure. For this study a hadron calorimeter is considered which covers the full 2π of azimuth and the entire rapidity interval between y = +-4 ($2.1^0 \leqq \theta \leqq 177.9^0$). Neither the effects of calorimeter resolution nor those of a magnetic field are considered.

28254 (BNL—51443-Vol.3, pp 930-972) **Magnetic hall detector.** Chen, M. (Massachusetts Inst. of Tech., Cambridge); Cheng, C.; Tang, H.W.; Warnock, J. 1981. NTIS, PC A16/MF A01.

From Physics opportunities at ISABELLE summer workshop; Upton, NY, USA (20 Jul 1981).

The records of high energy physics in the last decade are full of surprises and successes. Among these are the discoveries of new quarks and leptons and the success of gauge theories. The Glashaw - Weinberg - Salam SU(2) x U(1) model for the electromagnetic - weak interaction and QCD for the strong interaction are the highlights of the latter. However, at present our scheme has not yet been completed; at least one additional quark is yet to be observed, and the discoveries of one or more Z^0 and W/sup +-/ either elementary or composite, at the mass values either as predicted by the standard model or their absence, will have profound impact on particle physics. If the theory of mass generation turns out to be correct, we have also to find the Higgs particle (or the technicolored particles). ISABELLE, the proton-proton collider which presumably comes in operation in 1986 with the center-of-mass energy of 700 GeV and the initial luminosity of 2×10^{31} cm^{-2} sec^{-1}, will certainly be one of the best places to study these new phenomena. However, the ultimate goal of ISABELLE could be still beyond these studies. Because of the large center-of-mass energy and the very high luminosity we can expect brand-new phenomena. Therefore major detectors at ISABELLE should have enough flexibility so that they can be modified in the later stage to look for the as yet unexpected, as well as the capability to study the standard phenomena with high precision at the first stage. Keeping these points in mind we proposed a high resolution muon/flavor spectrometer consisting of a 4KG, large volume (10 x 10 x 10 m^3) solenoidal magnet, high resolution vertex chamber, electromagnetic and hadronic calorimeter and muon chambers as one of the major facilities at ISA.

28255 (BNL—51443-Vol.3, pp 973-993) **Spherical ring imaging Cherenkov detector system with a weak magnetic field.** Ypsilantis, T. (Ecole Polytechnique, Paris, France); Urban, M.; Sequinot, J.; Ekelof, T. 1981. NTIS, PC A16/MF A01.

From Physics opportunities at ISABELLE summer workshop; Upton, NY, USA (20 Jul 1981).

With the successful tests of the Ring Imaging Cherenkov (RICH) photon drift detector where circular ring images containing ten points (converted photoelectrons) have been observed, it is now possible to envision a detector system for colliding beams which has many desirable properties. The photon detector operates with a fused quartz transparent (to 7.5 eV) window with a photoionizing gas TMAE (1 torr) admixed with methane (759 torr) thus it contains no exotic (single crystal) components and may be considered as off the shelf. The value of $N_0 = 81$ cm^{-1} presently achieved with TMAE is expected to rise to a value of 125 cm^{-1} with technical improvements of the drift detector. Recall that the number of points on the ring image $N = N_0 L \sin^2 \theta$ where L is the length of the radiator (cm) and $\cos \theta = 1/\text{eta}\ \beta$ where eta is the refractive index of the radiator and β the velocity of the charged particle.

28256 (BNL—51443-Vol.3, pp 994-996) **How well can we measure the jet-jet invariant mass at ISABELLE.** Abe, K. 1981. NTIS, PC A16/MF A01.

From Physics opportunities at ISABELLE summer workshop; Upton, NY, USA (20 Jul 1981).

In the design of a hadron calorimeter one must optimize (i) longitudinal length for total energy containment, (ii) sampling thickness, and (iii) material. The energy containment in the transverse direction does not become a problem in most colliding beam detectors because they tend to cover 2π in the phi direction and large coverage in the θ direction. To contain 99% of energy of a 50 GeV particle, one needs 5.5 absorption length of steel, which is 30% thicker than the requirement for 95% containment. However one should be reminded that a loss of 5% energy broadens the energy resolution by 25% compared with the value of full containment. Making the sampling thickness finer improves the energy resolution especially at lower energies, but below 2.5 cm steel, there is no improvement as long as we are dealing with particles above 10 GeV. Among the large detectors proposed so far, the dipole detector emphasizes good jet detections using an uranium calorimeter. Its anticipated mass resolution at the Z^0 mass ($Z^0 \rightarrow$ jet + jet) when the jets opening angle is above 60° is $\Delta M/M \sim 3\%$. The mass resolution of this level would make it possible to sort out new particles decaying into multi jets final states from QCD backgrounds.

28257 (BNL—51443-Vol.3, pp 997-1004) **Inclusive lepton and hadron spectra from QCD jets.** Csorna, S. (Vanderbilt Univ., Nashville, TN). 1981. NTIS, PC A16/MF A01.

From Physics opportunities at ISABELLE summer workshop; Upton, NY, USA (20 Jul 1981).

Inclusive spectra of leptons and hadrons were studied, in order to better understand the design criteria for detectors at ISABELLE; develop a quantitative understanding of how to measure semileptonic branching ratios of new flavored bare mesons (if they exist); and find signatures for new flavors apart from the well known dileptons coming from the bound state. The work done relies exclusively on the ISAJET Monte Carlo program.

28258 (BNL—51443-Vol.3, pp 1005-1012) **Multi-vertex detection.** Bacon, T. (Imperial Coll., London, England). 1981. NTIS, PC A16/MF A01.

From Physics opportunities at ISABELLE summer workshop; Upton, NY, USA (20 Jul 1981).

There are many postulated massive objects (Higgs mesons, technions, top quarks) which, depending on their masses, will decay predominantly to heavy flavors. The decay products will form jets which will generally look like those produced by light quarks. The events involving new objects can be signalled by lepton identification or by multiple jet production. The latter will require good calorimetry and/or particle tracking, possibly with particle identification, and will be subject to sizeable backgrounds. Another signature of heavy flavors and their parents is the weak decay of the ground states of hadrons containing b, c or t quarks, yielding multiple vertices within a millimeter or so of each other. This note suggests that an inner detector of relatively low cost can provide an off-line filter for the heavy flavors which would also reduce combinatorial background in reconstructing the lowest charmed particle states. At present, there is only an upper limit for the lifetime of the lowest hadrons containing b-quarks of about 2×10^{-12} seconds (reflecting the spatial resolution of present detectors at e^+e^- machines) but the mean life of the D-mesons is known to be about 3×10^{-13} seconds.

28259 (BNL—51443-Vol.3, pp 1008-1012) **Subcommittee report on the shape and strength of magnetic fields.** Pope, B. (Princeton Univ., NJ); Bregman, M.; Grannis, P.; Littenberg, L.; Luckey, D.; Rosensen, L.; Ypsilantis, T. 1981. NTIS, PC A16/MF A01.

From Physics opportunities at ISABELLE summer workshop; Upton, NY, USA (20 Jul 1981).

This subcommittee attempted to compare the properties of the canonical field shapes: dipole, solenoid and toroid. In addition, various options within each category were examined.

28260 (BNL—51443-Vol.3, pp 1013-1034) **Progress report on the dipole detector magnet.** Littenberg, L. 1981. NTIS, PC A16/MF A01.

From Physics opportunities at ISABELLE summer workshop; Upton, NY, USA (20 Jul 1981).

This is a brief summary of the work done by the magnet design subgroup of the Dipole Detector Collaboration charged with designing a dipole spectrometer magnet which satisfies the following criteria: (1) a 5.5 m-diameter calorimeter must be accommodated within it, (2) the central field should be 5 kgauss, upgradable to 15 kgauss, (3) there must be adequate field uniformity within a radius of $\sim$ 1.5 m of the center of the magnet, (4) forward going tracks must be unobstructed, (5) stray fields must be kept within reasonable limits, (6) the magnet must be cryostable, (7) access to apparatus within the magnet must be possible, and (8) the dipole and any associated compensating, forward spectrometer, etc., magnets must be compatible with the requirements of the ISA.

28261 (BNL—51443-Vol.3, pp 1035-1037) **Some thoughts on a dipole detector.** Bregman, M.K. 1981. NTIS, PC A16/MF A01.

From Physics opportunities at ISABELLE summer workshop; Upton, NY. USA (20 Jul 1981).

The dipole magnet considered for a large ISABELLE experiment has the following configuration: the field volume consists of a cylinder with diameter 5m and length 5m. It is envisioned as being constructed of two superconducting Helmholtz coils with an iron return surrounding them. The field is oriented perpendicularly to the beam. The major motivation behind choosing a dipole field came from studying Z^0 decay. At ISABELLE most objects produced in q anti q reactions are not produced at rest so they tend to decay asymmetrically in the lab frame. For dileptonic events one typically sees one high energy lepton close to the beam pipe and one of lower energy at a larger angle to the beam. The dipole field has a great advantage here as it can make a good measurement of both leptons. The dipole is unique in that it has equally good bening power for all values of θ (for a given phi).

28262 (BNL—51443-Vol.3, pp 1038-1047) **Evolution of the magnet design for lapdog.** Ahrens, L.; Aronson, S.; Foelsche, H. 1981. NTIS, PC A16/MF A01.

From Physics opportunities at ISABELLE summer workshop; Upton, NY, USA (20 Jul 1981).

In designing an experiment focussing upon high resolution studies for electrons and photons, several possible configurations of magnetic field were considered. This history, and some indication for the basis of choices made are given here. It must be realized that several specific constraints were imposed on this study. The energy resolution for electromagnetic detection should be optimum and the magnet should dominate neither the effort nor cost. The EM calorimeter was to be outside the field in the large angle domain; thus thick material in the magnet coil (or return within active aperture) was not desirable. Both axial and dipole/toroidal field orientations were considered the case of a dipole field on the circulating beams wasn't considered. The advantages and disadvantages of both are considered.

28263 (BNL—51443-Vol.3, pp 1048-1071) **Use of conventional magnets for 100 GeV physics.** Luckey, D.; Ting, S.C.C. (Massachusetts Inst. of Tech., Cambridge). 1981. NTIS, PC A16/MF A01.

From Physics opportunities at ISABELLE summer workshop; Upton, NY, USA (20 Jul 1981).

Some physicists expect the energy range of 100 GeV, soon to be opened up by new accelerators, to be dominated by vector bosons associated with the weak interaction. Among these the Z_0 is expected to have a mass near 90 GeV and a narrow width (GAMMA congruent to 3 GeV). If so, then new detectors will be hard pressed to achieve resolutions capable of resolving this width. The existence of a natural unit of resolution is an important change from rcent physics where the multiplicity is high, and hence most momenta low. We discuss some aspects of obtaining such resolutions.

28264 (BNL—51443-Vol.3, pp 1102-1104) **Comment on resolving double interactions at ISABELLE.** Johnson, R.A. 1981. NTIS, PC A16/MF A01.

From Physics opportunities at ISABELLE summer workshop; Upton, NY, USA (20 Jul 1981).

As smaller and smaller cross sections are investigated at Isabelle, backgrounds from double interactions become a larger and larger problem. There are two methods of distinguishing multiple interactions in a single bunch crossing: resolving the two interaction vertices and/or resolving the different interaction times. The purpose of this note is to show that the two methods provide orthogonal information and that both should be present in large Isabelle detectors.

28265 (BNL—51443-Vol.3, pp 1121-1133) **Calibration and monitoring of large detectors.** Beier, E.; Hagopian, V.; Jensen, H.; Marraffino, J.; Sticker, H.; Sumorok, K.; White, D.H. 1981. NTIS, PC A16/MF A01.

From Physics opportunities at ISABELLE summer workshop; Upton, NY, USA (20 Jul 1981).

The general problem of calibration and monitoring of an experimental setup has become increasingly more important and troublesome as detectors have become larger and more complex. Nonetheless, the physical quantities actually measured by any detector are simple, namely a charge or pulse height, a time interval or a position. It may be necessary to obtain either absolute or relative measurements of these quantities. The problems associated with that fall under the heading of calibration. It is also necessary to measure these quantities over an extended time with a presumption of both long term and short term stability. The establishment of this knowledge falls under the heading of monitoring. These two functions obviously overlap, but the distinction between them can be kept clear at least in an operational sense.

28266 (BNL—51443-Vol.4, pp 1272-1274) **Some usable wire detector configurations for ISABELLE.** Becker, U.; Capell, M. (Massachusetts Inst. of Tech., Cambridge). 1981. NTIS, PC A17/MF A01.

From Physics opportunities at ISABELLE summer workshop; Upton, NY, USA (20 Jul 1981).

The features of the principal central wire chambers in some existing (or close to) experiments were updated in a summary. All were developed for either e^+e^- colliders or low luminosity p anti p machines. Considering ISA intensities and the 10 ns bunched structure with 220 ns pause the following configurations were considered of merit: (A) a calorimeter around the beam pipe measures hadrons and thereby reduces the rate of penetrating particles (mostly muons) to conditions of low multiplicity. Very accurate momentum determination is possible in this case and has been described. (B) in the forward region, 4 to 20° from the beam, rates are high and tracks close. A new development of densely packed and affordable electronics offers the possibility of an effective detection device. (C) The central region $20 < \theta < 160°$ usually requires a tracking device. In an open (that is not shielded by a calorimeter) configuration the background has to be considered.

28267 **(BONN-IR—80-17) Optimization of the beam injection path for an energy-compressor system at the Bonn 2.5 GeV Synchrotron.** Nolden, F. (Bonn Univ. (Germany, F.R.). Physikalisches Inst.). Aug 1980. 67p. (In German). Fachinformationszentrum Energie, Physik, Mathematik, Karlsruhe, Germany, F.R.

Thesis.

In the present work it is investigated what kind of consequences on the beam optics of the injection system will result after the installing of the new energy-compressor system. Furthermore some possibilities are suggested to decrease the beam envelopes at some critical positions where they are especially large. In the front part of the injection system this can be attained by a shift of the quadrupole Q1-Q4. Hereby one can generate more space between the quadrupoles, the necessary quadrupole power can be decreased and the envelopes become smaller. The decrease of the beam envelopes close to the magnet M1 can be obtained by the assembly of a new quadrupole Q1 behind magnet M3. To restore the achromatism, the quadrupoles Q5 and Q6 have to be readjusted, that yields the desired effect of a smaller beam at M1. The quadrupole Q7 was designed and measured as air-core solenoid quadrupole. By a measurement of the emittance ellipse of the linear accelerator the optical computations for the injection systems are put onto a safe base. The process-computer system at the synchrotron has been enhanced by the possibility to compute envelopes and phase ellipses out of the quadrupole currents measured by the computer and to represent them graphically.

28268 (CERN—81-07, pp 562-567) **DATEP: 120 channel PM h-v regulator.** Centro, S.; de Giorgi, M. (Istituto Nazionale di Fisica Nucleare, Padua (Italy)). 17 Jul 1981. Dep. NTIS (US Sales Only).

From Conference on the application of microprocessors to high energy physics experiments; Geneva, Switzerland (4 May 1981).

DATEP (Distributore Alta Tensione Programmabile) has been designed to distribute high voltage to some 1500 PM's for the gamma detectors (Part C) of EHS. Each unit has its own microprocessor controller which performs continuous checking of the 120 channels and allows operator interaction. Channel regulators

are based on a specially developed thick film hybrid circuit that allows to get on overall temperature coefficient better than 50 ppM/°C.

28269 (CERN—81-07, pp 569-572) **Touch terminal.** Anderssen, P.S.; Hatton, V.; Shering, G.; Stumpe, B. 17 Jul 1981. Dep. NTIS (US Sales Only).

From Conference on the application of microprocessors to high energy physics experiments; Geneva, Switzerland (4 May 1981).

The Touch Terminal is a microprocessor based intelligent terminal specially geared to the control of complex processes. It would be ideally suited to the control of a high energy physics experiment. It incorporates three of the features which have made the SPS control system a successful and widely acclaimed means of accelerator control. These are a touch panel with computer writable legends, a full graphics display screen, and a high level interpretive programming language. It can be used in two modes. First as a peripheral to any host computer, so providing the host with touch panel and display facilities at minimum overhead. Secondly, it can be used as a stand alone system with its own high level NODAL language. The terminal is compact and uses an internal 11 slot CAMAC bus. This enables the power of the terminal to be increased by adding appropriate CAMAC modules. A CAMAC controller using a powerful microprocessor provides the intelligence for the terminal operation.

28270 (GSI—81-1, pp 41-46) **Status report on ECR stripped ion sources at CEN Grenoble.** Geller, R.; Jacquot, B. Jan 1981. Dep. NTIS (US Sales Only).

From 2. international workshop on multiply charge electron resonance ion sources; Darmstadt, F.R. Germany (8 Dec 1980).

MICROMAFIOS is a small-scale version of SUPERMAFIOS (Briand et al. 1979, Geller et al. 1980); the confinement structure of the magnetic well of the stripper stage results from the superimposition of solenoidal magnetic field upon an hexapolar magnetic field created by permanent $SmCo_5$ magnets. This innovation leads to a very compact ion source (approx. 50 cm in length) which consumes < 100 kW of electric power (30 times less electricity than SUPERMAFIOS) and less than 2 kW of UHF power to create and heat the plasma. In addition, the coupling of the UHF waves to the plasma, has been simplified to the extreme. The incident wave is not polarised and the coupling is done in multimode cavities, whatever their shape. This eliminates the sophisticated technology of the profiled waveguides used in SUPERMAFIOS and the injection of the UHF power is made into the most convenient part of the multimode cavity. Thus, one does not take into consideration the theoretical anisotropic propagation of the waves in the magnetised plasma which presents preferential directions depending upon the polarisation modes of the wave and upon the dielectric coefficient of the plasma.

28271 (GSI—81-1, pp 70-72) **Construction of superconducting ECR magnets.** Dickens, M.H. Jan 1981. Dep. NTIS (US Sales Only).

From 2. international workshop on multiply charge electron resonance ion sources; Darmstadt, F.R. Germany (8 Dec 1980).

In the design of ion beam sources, such as the EBIS source manufactured by Cryogenic Consultants Limited for the University of Frankfurt, and the ECR source which we are currently building for the University of Louvain-la-Neuve in Belgium, there are a number of technical problems which determine the complexity and cost of the system, and which ultimately limit system performance. In the present talk, I will focus specifically on the effects, from the manufacturing viewpoint, of changing the size of the ECR plasma chamber, in the hope that this may help decision-making at the early design stages on the optimisation of the chamber size with respect to other parameters such as field strength and configuration, available microwave power etc. I will also discuss some technical ideas such as closed cycle refrigerated systems, and novel hexapole coil configurations which may be of general interest.

28272 (GSI—81-1, pp 157-164) **Charge exchange cross sections relevant for ISIS vacuum requirements.** Wucherer, P. Jan 1981. Dep. NTIS (US Sales Only).

From 2. international workshop on multiply charge electron resonance ion sources; Darmstadt, F.R. Germany (8 Dec 1980).

The measurement of multicharged ion electron loss cross sections in electron cyclotron-resonance ion sources is reported.

28273 (GSI—81-1, pp 165-169) **Scaling of measured ionization cross sections for argon and xenon.** Becker, R. Jan 1981. Dep. NTIS (US Sales Only).

From 2. international workshop on multiply charge electron resonance ion sources; Darmstadt, F.R. Germany (8 Dec 1980).

The calculation of charge spectra for sources of multiply charged ions requires the knowledge of the ionization cross sections involved, but instead of dealing with numerous experimental data, scaling laws may be more useful to get insight into the interdependence of parameters. Therefore only those measurements are considered here, which comprise several charge states of the same ion.

28274 (GSI—81-1, pp 181) **Collisions of fast highly stripped ions in gas targets. Charge transfer and ionization.** Schlachter, A.S.; Berkner, K.H.; Graham, W.G.; Pyle, R.V.; Stearns, J.W.; Tanis, J.A.; Olson, R.E. Jan 1981. Dep. NTIS (US Sales Only).

From 2. international workshop on multiply charge electron resonance ion sources; Darmstadt, F.R. Germany (8 Dec 1980).

28275 (INIS-mf—6819, pp 422) **Proton beam energy measurement at the U-240 cyclotron.** Grantsev, V.I.; Dryapachenko, I.P.; Kozeratskaya, G.N. 1981. (In Russian). Dep. NTIS (US Sales Only).

From 31. conference on nuclear spectroscopy and nuclear structure; Samarkand, USSR (14 Apr 1981).

28276 (INIS-mf—6819, pp 428) **Measuring the energy of an ion beam accelerated in a cyclotron.** Voronin, A.M.; Arzumanov, A.A.; Gor'kovets, M.S. 1981. (In Russian). Dep. NTIS (US Sales Only).

From 31. conference on nuclear spectroscopy and nuclear structure; Samarkand, USSR (14 Apr 1981).

28277 (INIS-mf—6819, pp 656) **New technique for shaping the beam with a wide energy spectrum on the U-150 cyclotron.** Begzhanov, R.B.; Valiev, G.S.; Gulamov, I.R.; Islamov, B.I.; Iskhakov, T.; Saidov, B.M.; Tsupin, A. 1981. (In Russian). Dep. NTIS (US Sales Only).

From 31. conference on nuclear spectroscopy and nuclear structure; Samarkand, USSR (14 Apr 1981).

28278 (LYCEN—8102, pp C9.1-C9.17) **Experimental program and the future of heavy ion physics at Ganil.** Lefort, M. (Societe Francaise d'Electrophysique, 78 - Sartrouville). [nd]. (In French). Dep. NTIS (US Sales Only).

From 6. biannual session of nuclear physics; Aussois, France (2 Feb 1981).

A broad sketch is made of the general trend followed by the study of collisions between heavy ions when the projectile energy increases from 10 towards 100 MeV per nucleon: a better knowledge of nuclear matter, the microscopic and the macroscopic approaches of the study of real nuclei, and the spectroscopy of rotating nuclei. Also the interest of GANIL facility for producing exotic nuclei is discussed. The actual choice of the various equipments which are prepared on the experimental area is the logic conclusion of the above considerations. A brief description is given of the three scattering chambers, of the spectrometer and of various other projects.

4304 Storage Rings

REFER ALSO TO CITATION(S) 28249, 28251, 28822

28279 (BNL—51443-Vol.1, pp 334-401) **Personal view of the ISABELLE project.** Ting, S.C.C. (Massachusetts Inst. of Tech., Cambridge). 1981. NTIS, PC A19/MF A01.

From Physics opportunities at ISABELLE summer workshop; Upton, NY, USA (20 Jul 1981).

One of the most important tasks an experimental physicist has is to select the right experiment to perform at the right accel-

erator at the right time. In the next ten years, the high energy physics community will be fortunate to have opportunities to work on (1) the 100 GeV e^+e^- colliding beam accelerator in Geneva, Switzerland, known as LEP; (2) a 2 TeV p anti p collider at FNAL; or (3) the high intensity 800 GeV proton-proton collider, ISABELLE. The principal physics interests for LEP would be the study of Z^0 physics, which includes the counting of neutrinos, the searching for Higgs, and the measuring of the weak angle, sin² θ/sub w/. LEP will also be useful in the search for new quark-antiquark states such as toponium. Experiments on strong interactions off resonance are very difficult to perform. This is because the hadron production cross section is very small at $\sqrt{s} \sim 100$ GeV. It would be difficult to obtain more than a few hundred hadron events per year at LEP. The p anti p collider at Fermilab will certainly explore some of the strong interaction physics at TeV regions and will be more competitive than the CERN p anti p collider at 540 GeV. However, because of the luminosity limitations it perhaps will not have the capacity to search for new particles much beyond 100 GeV mass. The principal physics interest at ISABELLE would be the utilization of its high luminosity to search for new, unpredicted phenomena, thus making a fundamental advance in our understanding of particle physics.

28280 (BNL—51443(Vol.2), pp 436-438) **Glueballs at ISABELLE.** Donoghue, J.F. (Univ. of Massachusetts, Amherst). 1981. NTIS, PC A18/MF A01.

From Physics opportunities at ISABELLE summer workshop; Upton, NY, USA (20 Jul 1981).

It is likely that in the near future there will be considerable interest in the experimental study of glueballs - bound states of gluons expected in QCD. Such efforts have already begun, primarily at SLAC and at the AGS. While ISABELLE is designed to emphasize other domains of high energy physics, it is possible that there may be open questions that ISABELLE can answer. It is the purpose of this brief note to try to anticipate some of these.

28281 (BNL—51443(Vol.2), pp 631-635) **Pions and interferometry in high-energy heavy-ion collisions at ISABELLE.** Miller, D.H. 1981. NTIS, PC A18/MF A01.

From Physics opportunities at ISABELLE summer workshop; Upton, NY, USA (20 Jul 1981).

There is increasing interest in the study of heavy-ion collisions at very high energies. At high enough temperatures and/or pressures there is now strong theoretical conviction that the QCD vacuum will undergo a phase transition to a state in which quarks and gluons are no longer confined. For the present, heavy-ion collisions at ultra-relativistic energies appear to offer the only laboratory technique for study of such phenomena.

28282 (BNL—51443(Vol.2), pp 655-658) **Report on e x p experiments at ISABELLE.** Holmes, S.D.; Lee, W.; Wilson, R.R. 1981. NTIS, PC A18/MF A01.

From Physics opportunities at ISABELLE summer workshop; Upton, NY, USA (20 Jul 1981).

This report is organized as follows: immediately following is the initial Isabele e-p proposal submitted in May 1981 and describing the physics, the detector, and an electron machine inside the Isabelle tunnel. This is followed by sections discussing the relative merits of rings inside or outside the Isabelle tunnel, approximate cost estimates, and a brief description of the polarization work.

28283 (BNL—51443(Vol.2), pp 737-743) **Electron-proton interactions.** Wilson, R.R. 1981. NTIS, PC A18/MF A01.

From Physics opportunities at ISABELLE summer workshop; Upton, NY, USA (20 Jul 1981).

Today we want to address two questions: the desirability of ep physics at Isabelle, and how and when it might be done. We will describe a particular detector and the important physics that will be forthcoming at particular energies and integrated luminosities, and make a few comments about where an electron ring might be located and when it might be used.

28284 (BNL—51443-Vol.3, pp 812-826) **Report of the subgroup on experimental area upgrades.** Aronson, S.; Gollon, P.; Kantardjian, G.; Lanou, R.; Miller, D.; Pope, B.; Theriot, D.; Walker, W. 1981. NTIS, PC A16/MF A01.

From Physics opportunities at ISABELLE summer workshop; Upton, NY, USA (20 Jul 1981).

This subgroup has been charged with the task of reconsidering these areas from the point of view of useability in the ISABELLE experimental program. As a result we have developed an ordered list of suggested improvements to each of the areas. The list is presented area-by-area, after some introductory remarks on the design considerations behind the present areas. The purpose of the list is to indicate the eventual scope of ISABELLE experimental areas, not to suggest that these upgrades should be put in place now. Indeed, although most of these additions will be needed regardless of which experiments are carried out, we think it prudent to wait for experiment approvals before the final design and installation of the suggested improvements.

28285 (BNL—51443-Vol.3, pp 824-826) **Report of experimental areas 10 and 12 group.** Aronson, S.; Ashford, V.; Becker, U.; Branson, J.; Grannis, P.; Lanou, R.E.; Lowenstein, D.I.; Luckey, D.; Ting, S.C.C.; Walker, W. 1981. NTIS, PC A16/MF A01.

From Physics opportunities at ISABELLE summer workshop; Upton, NY, USA (20 Jul 1981).

The question that has been put forth is how to proceed with the last two undeveloped experimental areas, 10 and 12. This has been reviewed with the boundary conditions of a 1986 or a 1988 ISA turn-on date and the possible options of a booster and an additional electron ring. In all cases, the final conclusion is to do the minimum required for the completion of the accelerator and wait until the approval of the first round of experiments to design and construct the experimental areas.

28286 (BNL—51443-Vol.3, pp 835) **Large experimental halls.** Luckey, D. (Massachusetts Inst. of Tech., Cambridge). 1981. NTIS, PC A16/MF A01.

From Physics opportunities at ISABELLE summer workshop; Upton, NY, USA (20 Jul 1981).

If 100 GeV physics has such particles as the Z_0 with a narrow width and low multiplicity decays then some detectors will need resolutions of the order of this width (1%). In contrast to recent hadronic physics, we will have to measure high moments well, and this will be a major challenge to detector designers in terms of BL^2 and mechanical accuracy.

28287 (BNL—51443-Vol.3, pp 839-842) **Limitations of a self-shielding experiment.** Gollon, P.J. 1981. NTIS, PC A16/MF A01.

From Physics opportunities at ISABELLE summer workshop; Upton, NY, USA (20 Jul 1981).

It has been suggested several times that one or another particularly massive (and expensive) experiment might be able to economize on shielding by getting recognition for the shielding provided by the apparatus itself. Circumstances underwhich this may be done are examined.

28288 (BNL—51443-Vol.4, pp 1487) **Superconducting electronics at ISABELLE.** Shpiz, J.M. (City Coll. of New York, NY). 1981. NTIS, PC A17/MF A01.

From Physics opportunities at ISABELLE summer workshop; Upton, NY, USA (20 Jul 1981).

The expected high event rate at ISABELLE due to the exceptionally high luminosity is expected to reach the limit of the speed of present state-of-the-art electronics. Present computers are limited in their memory storage and retrieval speed by I^2R heating which limits the size of the integrated circuits. It is suggested here that the massive refrigerated areas will provide a ready environment for superconducting memory and computing arrays.

44 INSTRUMENTATION

4401 Radiation Instrumentation

REFER ALSO TO CITATION(S) 27733, 28012, 28024, 28176, 28179, 28181, 28181, 28183, 28184, 28186, 28188, 28189, 28249, 28250, 28251, 28252, 28253, 28254, 28255, 28256, 28257, 28258, 28259, 28260, 28261, 28262, 28263, 28265, 28266, 28269, 28284, 28285, 28286, 28287, 28288, 28806, 28840, 28969, 28970

28289 (BNL—51443-Vol.3, pp 910-929) **Lapdog: a large angle electromagnetic experiment for ISABELLE.** Ahrens, L.; Aronson, S.; Foelsche, H. 1981. NTIS, PC A16/MF A01.

From Physics opportunities at ISABELLE summer workshop; Upton, NY, USA (20 Jul 1981).

In the summer of 1980, a group of physicists from Brookhaven, Brown and Stony Book held a small workshop to begin development of a proposal for ISABELLE, aimed at high resolution studies of π^0, γ, and electrons. Although we make no pretense of predicting which questions will be most fundamental when beams begin circulating, it seems a very good bet that the high luminosity afforded by ISABELLE, will enable exciting new work in the realm of short distance (high mass and high p/sub T/) phenomena. With our eye on this kind of physics, we have focussed on detection of electrons and gammas, feeling that the widest range of studies can thereby be enabled - without an excessively large detector.

28290 (BNL—51443-Vol.3, pp 1108-1113) **Some lessons learned from a high intensity experiment at the AGS.** Johnson, R.A. 1981. NTIS, PC A16/MF A01.

From Physics opportunities at ISABELLE summer workshop; Upton, NY, USA (20 Jul 1981).

In 1978 when the BNL-Princeton-Illinois collaboration first proposed on eta/sub c/ search to the high energy advisory committee at Brookhaven, one of our hopes was that this experiment would provide an existence proof that photomultiplier calorimetry could operate in high rate environments. That proof was not as easy as we anticipated. In our first run in 1979 rate effects killed the experiment for approximately 95% of the time and at the same time killed any chance we had of measuring small cross sections. I foresee a similar danger for first round Isabelle experiments as they try to cope with high intensities. In this report I will discuss some of our problems and solutions that allowed us to do calorimetry in an environment of 10^7 particles/sec in our second run in 1980. These are presented in the spirit of a warning about areas of concern and not as the ideal solution for all experiments.

28291 (BNL—51443-Vol.4, pp 1153-1164) **Electronic noise and resolving time in large wire chamber calorimeters.** Radeka, V.; Williams, H.H. 1981. NTIS, PC A17/MF A01.

From Physics opportunities at ISABELLE summer workshop; Upton, NY, USA (20 Jul 1981).

Wire chamber or proportional tube sampling in large calorimeters, such as those to be used in colliding beams experiments at ISABELLE, offer several important features. Foremost among these are capability to operate in a magnetic field, ease of segmentation (particularly if the induced signals on cathode pads are read out), and reasonably short resolving time. The capacitance of such detectors is quite large, however, and at very short shaping times, electronic noise becomes significant. There exist many different types of wire sampling including: (1) multiwire proportional chambers (MWPC) with anode readout, (2) proportional tubes with anode readout, (3) MWPC and proportional tubes with cathode pad readout, and (4) geiger-mode and limited streamer chambers with or without cathode pads. The latter types (4) result in very large avalanches and presumably are not suitable for high rate environments due to space charge effects and chamber lifetime considerations. We concentrate on (2) since the relative ease of construction and ruggedness of proportional tubes has already resulted in their being used in large calorimeter systems. The results of this analysis are applicable to (1) and (3).

28292 (BNL—51443-Vol.4, pp 1165-1166) **Rate estimate for a self-quenching streamer hadron calorimeter at isabelle.** Atac, M. (Fermilab, Batavia, IL). 1981. NTIS, PC A17/MF A01.

From Physics opportunities at ISABELLE summer workshop; Upton, NY, USA (20 Jul 1981).

We consider a hadron calorimeter composed of 35 one-inch iron plates and 35 extruded aluminum chambers.

28293 (BNL—51443-Vol.4, pp 1168-1222) **Very large and accurate drift chamber.** Becker, U.; Chen, M.; Chen, Y.H. 1981. NTIS, PC A17/MF A01.

From Physics opportunities at ISABELLE summer workshop; Upton, NY, USA (20 Jul 1981).

The energies of colliders have increased from the SPEAR/DORIS $\sim$ 2 x 5 GeV to PETRA/PEP $\sim$ 2 x 20 GeV and are now approaching 2 x 270 GeV at the CERN collider. The energy increase was by no means matched by the analyzing powers of the detectors remaining within factors two at the original configuration of B l = 5 1 kgauss-meter. We recall that new particles in fact can and have been detected from hadronic reactions; however, excellent mass resolution was necessary, which was just barely enough to establish the multiple states T, T', T''. Therefore we must ask the question whether $\Delta m/m = 1\%$ at, say, 100 GeV is indeed feasible as to have a detector with the potential of resolving multiple states and measuring the width of Z^0 accurately enough to determine the number of neutrino channels it may decay into. Such a detector is shown in the side view and in an end view. A 15 kgauss solenoidal field was chosen and a central drift chamber samples the track over l = 2 m in order to maximize the resolution, which is proportional to Bl^2. Hadrons are measured in the inner calorimeter, shielding the chamber from high multiplicity confusion. Muons will penetrate the calorimeter, be momentum analyzed in the chamber, and be identified by penetration into the outer chamber through the iron yoke.

28294 (BNL—51443-Vol.4, pp 1223-1228) **Experience with the axial field spectrometer drift chamber at the ISR.** Brookhaven-CERN-Copenhagen-Lund-Rutherford-Tel-Aviv Collaboration. (European Organization for Nuclear Research, Geneva, Switzerland). 1981. NTIS, PC A17/MF A01.

From Physics opportunities at ISABELLE summer workshop; Upton, NY, USA (20 Jul 1981).

The Axial Field Spectrometer (AFS) at the CERN ISR was designed to study events characterized by large transverse momenta. It required a low mass vertex detector providing good momentum resolution in a solenoidal magnetic field of 0.5 T, powerful pattern recognition for high event rates and particle densities and particle identification in the non-relativistic region (1). The detector has been operated at typical luminosities up to $L = 2 \times 10^{31}/cm^2$ sec over the past 1.5 years and recently, for periods of hours only, up to $L = 10^{32}/cm^2$ sec.

28295 (BNL—51443-Vol.4, pp 1250-1256) **Vertex detector.** Duinker, P.; Guo, J.C.; Harting, D.; Hartjes, F.; Hertzberger, B.; Konijn, J.; Massaro, G.G.G. 1981. NTIS, PC A17/MF A01.

From Physics opportunities at ISABELLE summer workshop; Upton, NY, USA (20 Jul 1981).

A special chamber with 96 wires was used in the test beam at BNL from December 1980 to March 1981. The purpose of the measurement was to verify indeed improves with the number of track samples N = 96.

28296 (BNL—51443-Vol.4, pp 1257-1271) **Proportional drift tubes for the neutrino experiment at BNL.** Amako, K. 1981. NTIS, PC A17/MF A01.

From Physics opportunities at ISABELLE summer workshop; Upton, NY, USA (20 Jul 1981).

The property of the PDT was measured by radiating several sample cells in the A.G.S. test beam. The gas used was P10 (Ar 90% + CH_4 10%). The position-time relation in normal beam entrance is shown. The pulse height distributions for π^+, e^+ and p at 0.8 GeV/c are shown. The pulse height resolution for all particles is $\sim$ 50% (FWHM). The peak values of the pulse height of π^+, e^+ and p at various momenta are shown. We are now running the experiment with 64 modules ($\sim$ 1/2 of full detector). We have been running more than one month without any damaged PDT cells. We have replaced $\sim$ 30 broken electronics boards. This number corresponding to $\sim$ 3% of entire PDT electronics. The raw pulse height distribution of minimum ionizing particles which go through all detectors is shown. It shows a clean Landau distribution even though it is the summing up of pulse height information from different modules. The resolution is $\sim$ 80% even without a correction for

incident angle of the particle or gas gain compensation from one module to another.

28297 (BNL—51443-Vol.4, pp 1275-1277) **Comments on chamber lifetime.** Hilke, H.J. (European Organization for Nuclear Research, Geneva, Switzerland). 1981. NTIS, PC A17/MF A01.

From Physics opportunities at ISABELLE summer workshop; Upton, NY, USA (20 Jul 1981).

We summarize previous measurements on chamber deterioration - due to deposit formation on the electrodes - and comment on some new results. To define a scale, we take typical irradiation levels found at the ISR for 30 x 30 GeV pp with L = 10^{31}/cm^2 sec. The values were measured in the inner section of the AFS drift chamber: R = 20 - 31 cm, Δphi = 4^0, sense wire separation = 8 mm.

28298 (BNL—51443-Vol.4, pp 1278-1282) **Status and prospects of laser beam calibration for imaging chambers.** Hilke, H.J. (European Organization for Nuclear Research, Geneva, Switzerland). 1981. NTIS, PC A17/MF A01.

From Physics opportunities at ISABELLE summer workshop; Upton, NY, USA (20 Jul 1981).

Large imaging chambers, designed for precise tracking and particle identification, require rapid and powerful calibration techniques. The most interesting features of laser induced ionization tracks for this application are: no deflection in a magnetic field, no δ electron emission, precise definition in space, time and amplitude (no Landau fluctuations), repeatability, simplicity and flexibility and simple two track formation.

28299 (BNL—51443-Vol.4, pp 1283-1308) **Mechanical accuracy of large frames achieved by computer feedback.** Paradiso, J.A. (Massachusetts Inst. of Tech., Cambridge). 1981. NTIS, PC A17/MF A01.

From Physics opportunities at ISABELLE summer workshop; Upton, NY, USA (20 Jul 1981).

Tracking high energy particles from the upcoming generation of colliders through magnetic fields of 10 to 20 kgauss will pose new problems because of the extremely small deflections involved. Accuracy of survey measurements is essential for providing high resolution in detectors using precision drift chambers. For example, in a detector for operation at ISABELLE, 96 large drift-chamber packages (5 x 1.6 meters in area) will be mounted in equiangular segments about the intersection region. This size, together with a 1% momentum resolution requirement at 40 GeV, is a considerable step up from present day central detectors. To fully utilize the resolving power of drift chambers (sigma/sub D/ ~ 150 μ m), the supporting structure must be reproducible to an amount Δx << sigma/sub D/. Stresses introduced via temperature variation, pressurization, gravitational and tensor forces, settling, etc., are expected to deform the chambers and affect the accuracy of the initial survey measurements over a long time period. To effectively confront this problem, we have developed a simple position-monitoring system employing optically sensitive charged-coupling device (CCD) arrays. Even though a digital position monitoring device is more elaborate than analog designs, we choose the digital approach for long term stability; i.e., the digital centroid will be insensitive to long-term fluctuations due to temperature and other factors.

28300 (BNL—51443-Vol.4, pp 1311-1314) **Conventional dE/dx.** Walenta, A.H. 1981. NTIS, PC A17/MF A01.

From Physics opportunities at ISABELLE summer workshop; Upton, NY, USA (20 Jul 1981).

Particle identification by measurement of the relativistic rise of energy loss has the advantage of being automatically available from the pulse height of the tracking drift chamber system avoiding pattern recognition and correlation problems because whenever a track has been found, in principle the pulse height in connection with the curvature gives the momentum and mass of the particle. A few devices have been built and results are expected soon. In preliminary measurements, however, one notices that the design resolution is not reached which is attributed to the lack of calibration possibilities for the large number of individual channels and variations in gas gain as function of a number of parameters. Since the advantage of combined tracking and particle identification is so obvious a detector for ISABELLE is proposed providing adequate e/π/K/-separation and an effort is spent to include a calibration system avoiding the shortcomings of existing systems.

28301 (BNL—51443-Vol.4, pp 1339-1344) **Threshold Cerenkov counters with photoionization detectors.** Capell, M. (Massachusetts Inst. of Tech., Cambridge); Walenta, A.H. 1981. NTIS, PC A17/MF A01.

From Physics opportunities at ISABELLE summer workshop; Upton, NY, USA (20 Jul 1981).

Threshold Cherenkov counters represent a reliable tool in particle physics for particle identification. In experiments at intersecting storage rings they are only used occasionally and never to cover the full solid angle. The use of phototubes for light detection is prohibitive to design them with the desired qualities: operation in a magnetic field and fine segmentation. A new development, however, makes it attractive to study such a setup for a possible ISABELLE experiment. A photosensitive proportional counter serves as light detector and the useful spectral range is determined by the lowest photon energy able to ionize an organic vapor added to the counting gas (e.g., benzene, hν/sub ion/ = 9.2 eV) and the transparency limit of the window (e.g., LiF, hν/sub ma/ = 11.8 eV) sealing the counting gas from the Cherenkov medium.

28302 (BNL—51443-Vol.4, pp 1345-1355) **Ring-imaging Cherenkov counters.** Beingessnen, J.; Kirz, J.; Walenta, A.H. 1981. NTIS, PC A17/MF A01.

From Physics opportunities at ISABELLE summer workshop; Upton, NY, USA (20 Jul 1981).

In order to achieve the highest possible segmentation and sensitivity for particle identification a ring-imaging Cherenkov counter has been proposed where the uv-part of the Cherenkov spectrum is used and the photons are detected in position sensitive proportional counters sensitized in the photon energy range in question. A detailed design of such counters surrounding an intersection point is described in these proceedings whereby a careful match of the tracking detector including the magnetic field with the two Cherenkov-ring-image units has been achieved to allow the reconstruction of multiparticle events or jets. In the following the question of a more general use and the compatibility with other magnetic track detectors as well as the high rate capabilities will be investigated.

28303 (BNL—51443-Vol.4, pp 1356-1377) **Identification of 200 GeV/c hadrons over a wide aperture.** McCarthy, R.L. (State Univ. of New York, Stony Brook). 1981. NTIS, PC A17/MF A01.

From Physics opportunities at ISABELLE summer workshop; Upton, NY, USA (20 Jul 1981).

A CERN, Saclay, Stony Brook collaboration is constructing a wide-aperture ring-imaging Cherenkov counter for a high P/sub T/ experiment at Fermilab (E605). Prototype tests indicate that our device will identify hadrons at least up to 200 GeV/c in momentum. Hence our technique is directly applicable to the forward-backward regions at ISABELLE if used in conjuction with magnetic analysis (which should ensure a low particle density in the detector).

28304 (BNL—51443-Vol.4, pp 1395-1403) **Possibilities of using the Pitt optical triggering device for ring recognition in disk Cherenkov counters.** Thompson, J. 1981. NTIS, PC A17/MF A01.

From Physics opportunities at ISABELLE summer workshop; Upton, NY, USA (20 Jul 1981).

At the University of Pittsburgh an incoherent optical processor is under development for use as an element in high energy physics triggers. The idea depends upon the distribution of light from an LED laser, into a preselected pattern onto an output plane. The LED or laser is triggered by a high energy detector element. In the output plane, light from each (optically independent) triggered light source adds incoherently. The pattern in which the light is focussed at the optical output light sources (or, equivalently, in the high energy physics detector elements) a large amount of light will be concentrated at the position of a light detector element in the output plane.

28305 (BNL—51443-Vol.4, pp 1404-1405) **Transition radiation.** Thompson, J. 1981. NTIS, PC A17/MF A01.

From Physics opportunities at ISABELLE summer workshop; Upton, NY, USA (20 Jul 1981).

An improvement in particle separation at low γ ($\sim 10^3$) and development of a practical transition radiation detector using a relatively simple electronic count of charge clusters has been described by Fabjan, Willis and collaborators. The count of charge clusters distinguishes rather well between the low number of clusters from ionization of the primary particle and the higher number from transition radiation quanta. The range of the detector is $\gamma \sim 10^3$ - 10^4. The detector is 10 x 10 cm^2 in cross section (MWPC to collect ionization) and 0.5 to 1.0 m long with 12 to 24 sets of radiators. The method requires 4 ADC's and a discriminator/radiator plane, to count the number of clusters with large amplitude collected at each plane. The speed of the device is set by the charge collection time, about 160 nanoseconds. The results are relatively stable over a wide range (2.5 to 4 keV) for the cluster threshold energy, and both π/e and K/π separation is quite good. The π/e separation achieved is $\sim$ 0.2% pion contamination for 90% electron efficiency for 10 to 15 GeV/c π's and electrons, with 12 sets of Li foil radiators spaced over $\sim$ 0.5 m length. For π's and K's at 140 GeV/c, 24 planes of carbon fibers were used as radiators, spaced over a 1.3 m length. With that configuration they reduced the pion contamination to 1 to 2% for 90% kaon efficiency.

28306 (BNL—51443-Vol.4, pp 1404-1405) **Electron identification via synchrotron radiation.** Kirz, J. (State Univ. of New York, Stony Brook); Walenta, A.H. 1981. NTIS, PC A17/MF A01.

From Physics opportunities at ISABELLE summer workshop; Upton, NY, USA (20 Jul 1981).

Detection of synchrotron radiation emitted by high energy electrons was successfully used for particle identification in the Λ β decay experiment at FNAL. We describe the basic idea here as it could be used at Isabelle.

28307 (BNL—51443-Vol.4, pp 1414-1424) **Tests of prototype solid state detectors.** Skubic, P.; Kalbfleisch, G.; Oostens, J. 1981. NTIS, PC A17/MF A01.

From Physics opportunities at ISABELLE summer workshop; Upton, NY, USA (20 Jul 1981).

Prototype position-sensitive semiconductor detectors with center-to-center strip spacing of 1 mm and approximately 300 microns thick have been tested with electrons from a Ru^{106} source and a 30 MeV linac. The average signal was 3.2 fc for minimum ionizing particles. A FET cascode charge sensitive amplifier gave a rms noise of 0.24 fc with the detector connected and the detector efficiency was measured to be (97 +- 2)%.

28308 (BNL—51443-Vol.4, pp 1425-1437) **Semiconductor detectors for high energy physics.** Braccini, P. (INFN, Pisa, Italy); Kraner, H.W.; Skubic, P.; Ludlam, T.; Radeka, V.; Coon, D.D. 1981. NTIS, PC A17/MF A01.

From Physics opportunities at ISABELLE summer workshop; Upton, NY, USA (20 Jul 1981).

Semiconductor detectors with position sensitivity have been rediscovered recently by high energy physicists in two dedicated conferences. Although the reported technology of this kind of detector is not necessarily new, the application to high energy physics has received recent impetus from the needs of storage ring machines such as ISABELLE. This report will include a brief introduction to the detectors themselves, their initial applications, further important applications attempting to suggest the scope of their usage, and a discussion of readouts and radiation damage.

28309 (BNL—51443-Vol.4, pp 1438-1449) **Fine grained hodoscopes based on scintillating optical fibers.** Borenstein, S.R. (York Coll., Jamaica, NY). 1981. NTIS, PC A17/MF A01.

From Physics opportunities at ISABELLE summer workshop; Upton, NY, USA (20 Jul 1981).

In order to exploit the high event rates at ISABELLE, it will be necessary to have fast detection with fine spatial resolution. The authors are currently constructing a prototype fine-grained hodoscope, the elements of which are scintillating optical fibers. The fibers have been drawn from commercially available plastic scintillator which has been clad with a thin layer of silicone. So far it has been demonstrated with one mm diameter fibers, that with a photodetector at each end, the fibers are more than 99% efficient for lengths of about 60 cm. The readout will be accomplished either with small diameter photomultiplier tubes or avalanche photodiodes used either in the linear or Geiger mode. The program of fiber development and evaluation will be described. The status of the APD as a readout element will be discussed. Finally, an optical encoding readout scheme will be described for events of low multiplicity.

28310 (BNL—51443-Vol.4, pp 1450-1455) **Update on micro-channel plates.** Smith, S.D. 1981. NTIS, PC A17/MF A01.

From Physics opportunities at ISABELLE summer workshop; Upton, NY, USA (20 Jul 1981).

During the nearly two years period beginning in late 1979, Brookhaven was fortunate to have Dr. Koichiro Oba, Director of Micro-channel Plate Development for the Hamamatsu TV Corporation as a full time visitor. He worked in collaboration with Dr. Pavel Rehak and occasionally myself. This report addresses only the issues of lifetime, quantum efficiency, and performance in a magnetic field.

28311 (BNL—51443-Vol.4, pp 1476-1484) **Optical computing - an alternate approach to trigger processing.** Cleland, W.E. 1981. NTIS, PC A17/MF A01.

From Physics opportunities at ISABELLE summer workshop; Upton, NY, USA (20 Jul 1981).

The enormous rate reduction factors required by most ISABELLE experiments suggest that we should examine every conceivable approach to trigger processing. One approach that has not received much attention by high energy physicists is optical data processing. The past few years have seen rapid advances in optoelectronic technology, stimulated mainly by the military and the communications industry. An intriguing question is whether one can utilize this technology together with the optical computing techniques that have been developed over the past two decades to develop a rapid trigger processor for high energy physics experiments. Optical data processing is a method for performing a few very specialized operations on data which is inherently two dimensional. Typical operations are the formation of convolution or correlation integrals between the input data and information stored in the processor in the form of an optical filter. Optical processors are classed as coherent or incoherent, according to the spatial coherence of the input wavefront. Typically, in a coherent processor a laser beam is modulated with a photographic transparency which represents the input data. In an incoherent processor, the input may be an incoherently illuminated transparency, but self-luminous objects, such as an oscilloscope trace, have also been used. We consider here an incoherent processor in which the input data is converted into an optical wavefront through the excitation of an array of point sources - either light emitting diodes or injection lasers.

28312 (BNL—51443-Vol.4, pp 1485-1486) **Planar, quasi-planar, and selectively blind tracking detector for very high multiplicity events.** Willis, W. (European Organization for Nuclear Research, Geneva, Switzerland). 1981. NTIS, PC A17/MF A01.

From Physics opportunities at ISABELLE summer workshop; Upton, NY, USA (20 Jul 1981).

No one has measured the upper tail of charged particle multiplicity at the ISR, though it might contain interesting physics. The reason is that it takes a rather special electronic detector to measure, say, 100 prong events. Consideration of nucleus-nucleus collisions, or even rare p-p events at ISABELLE energies, sharpens this problem. Here I mention some possible approaches to this problem, aside from the simplest one of sampling the high multiplicity event in a well-chosen particle acceptance.

28313 **(CEA-CONF—5736) Use on radioactive materials of the neutron radiographic installation of the ISIS reactor at Saclay. Setting up and exploitation of nitrocellulose in neutron radiography.** Barbalat, R. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Services des Piles). Jun 1981. 20p. (In French). NTIS (US Sales Only), PC A02/MF A01. Order Number DE81700707.Grenoble, France

Nitrocellulose is the plastic detector the more widely used in neutronography. The Kodak films type CA 8015 or CN 85 are examined; working conditions are: exposure with a fluence of 2.5×10^9 n/cm^2 and development with a KOH solution (150 g/l) at 40°C. Efficiency of convertissors, development constant and optical density are verified to optimize the nitrocellulose negative. Material and technique used for spent fuel examinations by neutronography, at the reactor ISIS are described.

28314 **(CEA-CONF—5738) Industrial applications of medical radiography 3-D by nuclear diffusion.** Charpak, G.; Duchazeaubeneix, J.C.; Faivre, J.C. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Service de Physique Nucleaire a Moyenne Energie). May 1981. 12p. (In French). (CONF-810540—7). NTIS (US Sales Only), PC A02/MF A01. Order Number DE81700695.

From 1. European conference on cineradiography with photons or particles; Paris, France (19 May 1981).

This work deals with the principle and the properties of nuclear 3-D scattering. As an illustration of the possibilities of the methode one gives 2 examples, the first one is the detection and localisation of defects, the other one is the 3D radiography of an electric motor. One gives also an application on the medical radiography.

28315 (CERN—81-07, pp 204-213) **Microprocessors in physics experiments at SLAC.** Rochester, L.S. (Stanford Linear Accelerator Center, CA (USA)). 17 Jul 1981. Dep. NTIS (US Sales Only).

From Conference on the application of microprocessors to high energy physics experiments; Geneva, Switzerland (4 May 1981).

The increasing size and complexity of high energy physics experiments is changing the way data are collected. To implement a trigger or event filter requires complex logic which may have to be modified as the experiment proceeds. Simply to monitor a detector, large amounts of data must be processed online. The use of microprocessors or other programmable devices can help to achieve these ends flexibly and economically. At SLAC, a number of microprocessor-based systems have been built and are in use in experimental setups, and others are now being developed. Existing systems, their use in experiment, developments in progress and future plans are reviewed.

28316 (CERN—81-07, pp 214-229) **Intelligent trigger processor for the crystal box.** Sanders, G.H.; Butler, H.S.; Cooper, M.D.; Hart, G.W.; Hoffman, C.M.; Hogan, G.E.; Matis, H.S.; Sandberg, V.D.; Williams, R.A. (Los Alamos Scientific Lab., NM (USA)); Hughes, E.B. (Stanford Univ., CA (USA). High Energy Physics Div. 17 Jul 1981. Dep. NTIS (US Sales Only).

From Conference on the application of microprocessors to high energy physics experiments; Geneva, Switzerland (4 May 1981).

A large solid angle modular NaI (Tl) detector with 432 phototubes and 88 trigger scintillators is being used to search simultaneously for three lepton flavor changing decays of the muon. A beam of up to 10^6 muons stopping per second with a 6% duty factor would yield up to 1000 triggers per second from random triple coincidences. A reduction of the trigger rate to 10 Hz is required from a hardwired primary trigger processor. Further reduction to < 1 Hz is achieved by a microprocessor based secondary trigger processor. The primary trigger hardware imposes voter coincidence logic, stringent timing requirements, and a non-adjacency requirement in the trigger scintillators defined by hardwired circuits. Sophisticated geometric requirements are imposed by a PROM-based matrix logic, and energy and vector-momentum cuts are imposed by a hardwired processor using LSI flash ADC's and digital arithmetic logic. The secondary trigger employs four satellite microprocessors to do a sparse data scan, multiplex the data acquisition channels and apply additional event filtering.

28317 (CERN—81-07, pp 230-235) **Microprocessor based techniques at CESR.** Giannini, G. (State Univ. of New York, Stony Brook (USA); Cornell Univ., Ithaca, NY (USA). Wilson Lab.). 17 Jul 1981. Dep. NTIS (US Sales Only).

From Conference on the application of microprocessors to high energy physics experiments; Geneva, Switzerland (4 May 1981).

Microprocessor based systems succesfully used in connection with the High Energy Physics experimental program at the Cornell Electron Storage Ring are described. The multiprocessor calibration system for the CUSB calorimeter is analyzed in view of present and future applications.

28318 (CERN—81-07, pp 236-249) **How can fast programmable devices enhance the quality of particle experiments.** Luetjens, G. (Max-Planck-Institut fuer Physik und Astrophysik, Muenchen (Germany, F.R.)). 17 Jul 1981. Dep. NTIS (US Sales Only).

From Conference on the application of microprocessors to high energy physics experiments; Geneva, Switzerland (4 May 1981).

Techniques employed at CERN fixed target experiments are surveyed which filter data on-line and reduce apparatus dead time to data acquisition.

28319 (CERN—81-07, pp 250-257) **Use of fast processors for on line triggering and event filtering.** Berst, J.D.; Lecoq, J.; Meyer, J.M.; Perrin, M. (Mulhouse Univ., 68 (France). Lab. d'Electronique et d'Instrumentation Nucleaire; Strasbourg-1 Univ., 67 (France). Lab. de Physique du Noyau et de Physique des Particules). 17 Jul 1981. Dep. NTIS (US Sales Only).

From Conference on the application of microprocessors to high energy physics experiments; Geneva, Switzerland (4 May 1981).

Within the framework of 3 SPS experiment we have inserted (or we shall soon be doing so) one or more bit slice microprocessors in order to obtain: an improvement of data quality and time efficiency (software triggering, event filtering, data formatting), more flexibility in adapting to experimental conditions (during development and production). For experiment WA 2 (1976-1978), apart from the control of the multi DMA transfers, analysis by microprogrammes of ADC data, MWPC and TDC multiplicities (times compatible with transfer times from CAMAC to minicomputer) and TDC data formatting has made it possible to reject 70% of events. This in turn allows an efficient on line control and savings of approx. equal to 100 h CDC CPU time. In experiment NA 10 (1980-1981) physics requires an increase in beam intensity by a factor 10. 4 microprocessors working in parallel allows us to concile the readout data flow with the acquisition capacity of the two computers N 10-N 500 due to a factor 10 reduction of the data flow. The use of modular units adapting to the different readout systems (CAMAC, RmH...) and to the experiment (wired operators) permits easy integration. A complete development system (cross-assembler, micro-code compiler, loader) facilitates the updating of software.

28320 (CERN—81-07, pp 259-265) **CAMAC booster (CAB system): a versatile microcomputer for high rate CAMAC data acquisition.** Barrelet, E.; Marbot, R.; Matricon, P. (Ecole Polytechnique, 91 - Palaiseau (France). Lab. de Physique Nucleaire et des Hautes Energies). 17 Jul 1981. Dep. NTIS (US Sales Only).

From Conference on the application of microprocessors to high energy physics experiments; Geneva, Switzerland (4 May 1981).

A first generation bit slice processor, named μ 77, has been used at CERN on a PS experiment from 1977 to 1979. A second generation processor called CAB (CAMAC Booster) has been used in 1980 for a follow-up experiment S 157b, also at CERN PS. During the last year more than 15 CABs have been built, and are

used in different applications. The specific aspects of this experience are discussed, namely the on-line physics at S 157 experiment and the 'CAMAC boosting' concept, after an abridged technical presentation of our CAB processor.

28321 (CERN—81-07, pp 278-283) **Dealing with distributed intelligence in monitoring and control systems.** McLaren, R.A. (European Organization for Nuclear Research, Geneva (Switzerland)). 17 Jul 1981. Dep. NTIS (US Sales Only).

From Conference on the application of microprocessors to high energy physics experiments; Geneva, Switzerland (4 May 1981).

The European Hybrid Spectrometer is built up of many individual detectors, each having widely varying monitoring and control requirements. With the advent of cheap microprocessor systems a shift from the concept of a single monitoring and control computer to that of distributed intelligent controllers has been economically feasible. A detector designer can now thoroughly test and debug a complete monitoring and control system on a local, dedicated micro-computer, while during operation, the central computer can be relieved of many simple repetitive tasks. Rapidly, however, it has become obvious that the designers of these systems have to take into account the final operational environment and build into both the hardware and software, features allowing easy integration into a central monitoring and control chain. In addition, the problems of maintenance and enventual modification have to be taken into consideration early in the development. Examples of currently operational systems will be briefly described to demonstrate how a set of basic guidelines plus standardization of hardware/software can minimise the problems of integration and maintenance. Based on practical experience gained in the European Hybrid Spectrometer, investigations are proceeding on various possible alternatives for future micro-computer based monitoring and control systems.

28322 (CERN—81-07, pp 284-289) **Mini- and microprocessors and FASTBUS in the experimental program at BNL.** Leipuner, L.B. (Brookhaven National Lab., Upton, NY (USA)). 17 Jul 1981. Dep. NTIS (US Sales Only).

From Conference on the application of microprocessors to high energy physics experiments; Geneva, Switzerland (4 May 1981).

The use of small processors in the experimental program at Brookhaven will be reviewed. FASTBUS, a new data acquisition system, as developed at BNL will also be reviewed. New directions that are planned in these areas will be discussed.

28323 (CERN—81-07, pp 294-302) **Camapple: CAMAC interface to the Apple computer.** Oxoby, G.J.; Trang, Q.H.; Williams, S.H. (Stanford Linear Accelerator Center, CA (USA)). 17 Jul 1981. Dep. NTIS (US Sales Only).

From Conference on the application of microprocessors to high energy physics experiments; Geneva, Switzerland (4 May 1981).

The advent of the personal microcomputer provides a new tool for the debugging, calibration and monitoring of small scale physics apparatus, e.g., a single detector being developed for a larger physics apparatus. With an appropriate interface these microcomputer systems provide a low cost (1/3 the cost of a comparable minicomputer system), convenient, dedicated, portable system which can be used in a fashion similar to that of portable oscilliscopes. An interface is described between the Apple computer and CAMAC which is now being used to study the detector for a Cherenkov ring-imaging device. The Apple is particularly well-suited to this application because of its ease of use, hi-resolution graphics, peripheral bus and documentation support.

28324 (CERN—81-07, pp 303-315) **On-line filtering at the CERN-ISR.** Frehse, H. (European Organization for Nuclear Research, Geneva (Switzerland)). 17 Jul 1981. Dep. NTIS (US Sales Only).

From Conference on the application of microprocessors to high energy physics experiments; Geneva, Switzerland (4 May 1981).

During the last years it has become quite evident that one should aim at trigger systems with high selectivity in order to improve the purity of data and simultaneously remove load from the off-line processing. At the CERN ISR typical pp interaction rates are in the order of 1-3 MHz. Therefore experiments studying low cross section processes need trigger systems which provide reduction factors in the order of 10^6 to avoid dead time losses. The use of programmable devices, allowing for flexible and sophisticated decision schemes, enables experiments to gain a decisive factor in rejection after pre-triggering with more conventional devices. An overview of the different methods employed and their performance is given.

28325 (CERN—81-07, pp 316-320) **Calorimeter trigger system for the ISR axial field spectrometer.** Rosselet, L. 17 Jul 1981. Dep. NTIS (US Sales Only).

From Conference on the application of microprocessors to high energy physics experiments; Geneva, Switzerland (4 May 1981).

A fast and flexible trigger processor system designed to run in parallel up to 51 different types of trigger is used in a large hadron calorimeter experiment at CERN-ISR. A very fast data bus connected to 255 10 bit address ECE memory chips allows programmable selection of events according to their topology and energy pattern in less than 150 ns. In addition this system can interrogate two programmable processors (ESOP) to isolate events characterized by a large energy flow in the central drift chamber (< 500 μs). All functions of the trigger processor can be checked externally by a computer through injecting in parallel simulated input signals into various stages of the system. Salient features and performances will be discussed.

28326 (CERN—81-07, pp 321-328) **Microprogrammable processor ESOP in the AFS trigger system.** Ciaranti, S.; Heck, B.; Rosselet, L. (European Organization for Nuclear Research, Geneva (Switzerland)); Hooper, J.E.; Nielsen, S.O.; Schistad, B.L. (Niels Bohr Inst., Copenhagen (Denmark)); Killian, T. (Brookhaven National Lab., Upton, NY (USA)). 17 Jul 1981. Dep. NTIS (US Sales Only).

From Conference on the application of microprocessors to high energy physics experiments; Geneva, Switzerland (4 May 1981).

A programmable processor is used on-line in the trigger system of the Axial Field Spectrometer for selecting events with a charged particle of high transverse momentum. After having formed a pretrigger by using signals from proportional chambers, a selected part of the data from the cylindrical drift chamber is transfered into the memory of the processor. The track sagitta of the triggering particle is calculated. Only if it is smaller than a predefined value the event is accepted and recorded on magnetic tape. The implementation of the processor in the electronics of the experiment and the software procedures are discussed together with the performance of the system.

28327 (CERN—81-07, pp 329-335) **On-line use of the 168/E emulator at the CERN ISR SFM detector.** Bertuzzi, C.; Drijard, D.; Frehse, H.; Gavillet, P.; Gokieli, R.; Innocenti, P.G.; Messerli, R.; Mornacchi, G.; Norton, A.; Porte, J.P. 17 Jul 1981. Dep. NTIS (US Sales Only).

From Conference on the application of microprocessors to high energy physics experiments; Geneva, Switzerland (4 May 1981).

The Split Field Magnet Detector at the CERN ISR has been used in recent years to study events with a high transverse momentum charged particle. As a first level computer based trigger a linear estimate of the track momentum by fixed point arithmethic was calculated on-line by a minicomputer. In addition appreciable further rejection was obtained by off-line filtering on the IBM-370/168, using pattern recognition and a fit of the triggering particle in the magnetic field. The availability of the 168/E emulator makes it possible to transfer the proven methods used off-line to real time data reduction. Preliminary results on filter efficiency and speed for an experiment triggering on a high P/sub T/ hadron at 10 to 20° with respect to the outgoing beam (Exp. R 419) are given. Possible improvements and extensions are discussed.

28328 (CERN—81-07, pp 341-354) **168/E at CERN and the MARK 2. An improved processor design.** Kunz, P. (Stanford Linear Accelerator Center, CA (USA)); Botterill, D.R. (Science Research Council, Chilton (UK). Rutherford and Appleton Labs.); Lord, D.; Edwards, A.; Fucci, A.; Lee, G.; Martin, B.; Mornacchi, G.; Scharff-Hansen, P.; Storr, M. 17 Jul 1981. Dep. NTIS (US Sales Only).

From Conference on the application of microprocessors to high energy physics experiments; Geneva, Switzerland (4 May 1981).

The history of the 168/E work at CERN is reviewed, followed by a short description of the hardware and software in use and finally some examples of future applications are given. The limitations of the present 168/E design are discussed and the ways that a new design, Mark 2, could overcome them are presented.

28329 (CERN—81-07, pp 355-386) **FASTBUS: a description, a status report, and a summary of ongoing projects.** Barsotti, E.J. (Fermi National Accelerator Lab., Batavia, IL (USA)). 17 Jul 1981. Dep. NTIS (US Sales Only).

From Conference on the application of microprocessors to high energy physics experiments; Geneva, Switzerland (4 May 1981).

FASTBUS is a modular data and control bus and mechanical packaging standard currently under development. It is being funded by the United States Department of Energy and fully supported by the European ESONE Committee. FASTBUS is being designed to meet the high-speed data acquisition and parallel and distributed processing requirements of the next generation of large-scale physics experiments. It is a multiprocessor system with multiple bus segments which operate independently but link together for passing data. It operates asynchronously to accommodate very high and very low speed devices over long and short paths, using handshake protocols for reliability. It can also operate synchronously without handshakes for transfer of data blocks at maximum speed. The motivation for developing FASTBUS, its goals, history and organizational structure are summarized. Its features such as bus protocols, sparse data scan capabilities, power supplies and mechanics, bus segmentation and parallel processing structures, etc. are described. European and United States systems being proposed or built using FASTBUS along with hardware and software projects to aid in the standard or system development are discussed. The present state of and development schedules for the FASTBUS standard are reviewed.

28330 (CERN—81-07, pp 387-394) **Simulation of the FASTBUS protocols.** Booth, A.W. 17 Jul 1981. Dep. NTIS (US Sales Only).

From Conference on the application of microprocessors to high energy physics experiments; Geneva, Switzerland (4 May 1981).

FASTBUS is a standard bus system being developed for high speed data acquisition and processing in the next generation of large scale physics experiments. Prototypes are being built according to a draft specification. The FASTBUS protocols have been simulated using a powerful software tool which is a computer description language. This Instruction Set Processor Specification language, ISPS, has been used in the design and development of several microprocessor systems. It's applications are diverse, including automated design and the generation of machine relative software, as well as simulation. The results of the FASTBUS simulation are presented, with an overview of the ISPS hardware description language. An additional facility is discussed, which supplements the simulation by providing a visual presentation of the FASTBUS signals, that is, a timing-graph generator.

28331 (CERN—81-07, pp 405-410) **Several uses of MC 68000 in CAMAC systems.** Brehin, S.; Briet, P.; Gentit, F.X.; Rousse, B. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Physique des Particules Elementaires). 17 Jul 1981. Dep. NTIS (US Sales Only).

From Conference on the application of microprocessors to high energy physics experiments; Geneva, Switzerland (4 May 1981).

CAMAC is the universally used standard in High Energy Physics experiments. In order to give to technicians a debugging and trouble shooting tool and to physicists a cheap system for apparatus test we have developed an Autonomous CAMAC Branch Driver using the MC 68000, 16 bits, microprocessor. To achieve it we have designed a powerful CAMAC interface and an interactive software allowing very simple use of this tool. In the same way we have also designed an Auxiliary Crate Controller, with an associated 64 K to 256 K words (16 bits) memory, for data acquisition and preprocessing at the CAMAC Crate level. Keeping in mind the same idea we are designing a new Branch Driver with a large memory, devoted to data acquisition and working as a frontal processor, at the CAMAC Branch level, for the main experiment computer.

28332 (CERN—81-07, pp 411) **Microprocessor controlled readout system for drift chambers.** Cesaroni, F.; Petrolo, E. (Rome Univ. (Italy)); Centro, S.; Cittolin, S.; Dreesen, P.; Rubbia, C.; Schinzel, D. 17 Jul 1981. Dep. NTIS (US Sales Only).

From Conference on the application of microprocessors to high energy physics experiments; Geneva, Switzerland (4 May 1981).

28333 (CERN—81-07, pp 412-417) **CADAS: a fast processor for ADC correction and readout.** Rehlich, K. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). 17 Jul 1981. Dep. NTIS (US Sales Only).

From Conference on the application of microprocessors to high energy physics experiments; Geneva, Switzerland (4 May 1981).

The TASSO detector at DESY is equipped with a liquid Argon shower calorimeter. A fast processor has been designed to correct the pedestal and gain values for each of the 11000 preamplifier and ADC channels to give a calibrated equivalent shower energy output. This one slot CAMAC module contains a 16 bit CPU built around AMD 2901 bit slices. Each module controls one CAMAC crate containing up to 320 ADC channels.

28334 (CERN—81-07, pp 418-426) **BDC 500 branch driver controller.** Dijksman, A.; Schoeps, W. (Schweizerisches Inst. fuer Nuklearforschung, Villigen). 17 Jul 1981. Dep. NTIS (US Sales Only).

From Conference on the application of microprocessors to high energy physics experiments; Geneva, Switzerland (4 May 1981).

This processor has been designed for very fast data acquisition and data pre-processing. The dataway and branch highway speeds have been optimized for approximately 1.5 μsec. The internal processor cycle is approximately 0.8 μsec.

28335 (CERN—81-07, pp 427-431) **Use of microinterrupts to provide an instrument oriented input/output structure.** Zaky, S.G. (Toronto Univ., Ontario (Canada). Dept. of Electrical Engineering). 17 Jul 1981. Dep. NTIS (US Sales Only).

From Conference on the application of microprocessors to high energy physics experiments; Geneva, Switzerland (4 May 1981).

The design of a bit-slice based computer is described, which has been developed for use in data acquisition and control applications. The main design goals have been to provide fast response to external events, and sufficient processing capability to perform data reduction in real time. The initial application of this computer has been in airborne, geophysical surveying, where such instruments as Gamma-ray spectrometers, magnetometers and navigation equipment are involved. In order to meet the response requirement mentioned above, a microinterrupt facility has been incorporated. Microinterrupts are serviced in microcodes routines which can be initiated within a maximum of two microinstruction cycle times from an external event. This facility makes it possible to implement powerful input/output control functions without the need for complex and specialized hardware interfaces for each instrument.

28336 (CERN—81-07, pp 432-443) **On-line-trigger-processors in PETRA/DORIS-experiments at DESY. Survey about the most important technical dates.** Oelschlaeger, R.; Struck, B. 17 Jul 1981. Dep. NTIS (US Sales Only).

From Conference on the application of microprocessors to high energy physics experiments; Geneva, Switzerland (4 May 1981).

28337 (CERN—81-07, pp 444-449) **Pattern recognition for track measurements in plastic nuclear track detectors.** Trakowski, W.; Schoefer, B.; Heinrich, W. (Gesamthochschule Siegen (Germany, F.R.). Fachbereich Naturwissenschaften 1 - Physik). 17 Jul 1981. Dep. NTIS (US Sales Only).

From Conference on the application of microprocessors to high energy physics experiments; Geneva, Switzerland (4 May 1981).

The tracks of heavily ionizing particles in plastic detectors can be made visible through a microscope by etching. The energy loss of the particles is determined by a measurement of the geometry of the etch cones. The technique of computerized track measurement opens new applications for plastic track detectors in experiments collecting large amounts of data. This technique is being used to measure the cross sections for projectile fragmentation of relativistic heavy ions. A picture analysis system enables us to do the track detection and measurement automatically. The video picture seen through a microscope is digitized in real time using a TRW 1007 digitizer. 512 x 512 picture elements are digitized with 8 bits of grey level and written into memory (MK 4118). A Motorola MC 68000 microprocessor has access to these data. Additionally to the 256 KB picture memory up to 128 KB programme memory can be used. Presently the software for the track measurements is based on the detection of elements with grey levels above a given threshold. The advantages of more sophisticated picture analysis techniques are under investigation.

28338 (CERN—81-07, pp 454-459) **XOP: a second generation fast processor for on-line use in high energy physics experiments.** Lingjaerde, T. 17 Jul 1981. Dep. NTIS (US Sales Only).

From Conference on the application of microprocessors to high energy physics experiments; Geneva, Switzerland (4 May 1981).

Processors for trigger calculations and data compression in high energy physics are characterized by a high data input capability combined with fas execution of relatively simple routines. In order to achieve the required performance it is advantageous to replace the classical computer instruction-set by microcoded instructions, the various fields of which control the internal subunits in parallel. The fast processor called ESOP is based on such a principle: the different operations are handled step by step by dedicated optimized modules under control of a central instruction unit. Thus, the arithmetic operations, address calculations, conditional checking, loop counts and next instruction evaluation all overlap in time. Based upon the experience from ESOP the architecture of a new processor XOP is beginning to take shape which will be faster and easier to use. In this context the most important innovations are: easy handling of operands in the arithmetic unit by means of three data buses and large data files, a powerful data addressing unit for easy handling of vectors, as well as single operands, and a very flexible logic for conditional branching. Input/output will be made transparent through the introduction of internal fast processors which will be used in conjunction with powerful firmware as a software debugging aid.

28339 (CERN—81-07, pp 460-470) **Two level triggering in storage ring experiments.** Stuckenberg, H.J. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). 17 Jul 1981. Dep. NTIS (US Sales Only).

From Conference on the application of microprocessors to high energy physics experiments; Geneva, Switzerland (4 May 1981).

Cylindrical storage ring detectors using more then ten thousand channels of drift-, proportional- and liquid argon chambers have led to an enormous increase in data acquisition rates stored in hundreds of tapes. To reduce the computer time for total analysis of the selected events one has to reject the undesired events as early as possible. Therefore the trigger should be more selective, i.e., not only by counting the number of tracks in an event but to reconstruct the track coordinates to get to know the topology. Because of the short decision time of some microseconds in typical PETRA/DORIS experiments this is done in two steps: at level 1 a parallel or sequential hardwired logic is used for getting the number of tracks together with some geometrical values, at level 2 a fast or several slower microprocessors are used running on a simple algorithm together with some hardware tricks. For future detectors with lower bunch crossing rates very fast microprocessors may be used also at the first level, at the second level more efficient algorithms are now designed and under test.

28340 (CERN—81-07, pp 460-470) **IMB nucleon decay detector data acquisition and triggering system.** LoSecco, J.; Shumard, E.; Van der Velde, J. (Michigan Univ., Ann Arbor (USA)); Cortez, B.; Foster, G.W. (Harvard Univ., Cambridge, MA (USA)). 17 Jul 1981. Dep. NTIS (US Sales Only).

From Conference on the application of microprocessors to high energy physics experiments; Geneva, Switzerland (4 May 1981).

The data acquisition hardware and software for large deep underground nucleon stability detector will be described. Such hardware must process the information from an array of greater than 2000 photomultiplier tubes in real time, in the presence of a cosmic ray background of about three events per second. A hierachical scheme of processors and memory is used to perform real time pattern recognition and events identification with negligible impact on dead time. Fast, but crude, algorithms have been developed to reduce the offline analysis work load without endangering any of the alternate physics objectives, such as neutrino oscillations or neutrino burst detection.

28341 (CERN—81-07, pp 479-487) **Microprocessor-based single board computer for high energy physics event pattern recognition.** Bernstein, H.; Gould, J.J.; Imossi, R.; Kopp, J.K.; Love, W.A.; Ozaki, S.; Platner, E.D. (Brookhaven National Lab., Upton, NY (USA)); Kramer, M.A. (City Coll., New York (USA)). 17 Jul 1981. Dep. NTIS (US Sales Only).

From Conference on the application of microprocessors to high energy physics experiments; Geneva, Switzerland (4 May 1981).

A single board MC 68000 based computer has been assembled and bench marked against the CDC 7600 running portions of the pattern recognition code used at the MPS. This computer has a floating coprocessor to achieve throughputs equivalent to several percent that of the 7600. A major part of this work was the construction of a FORTRAN compiler including assembler, linker and library. The intention of this work is to assemble a large number of these single board computers in a parallel FASTBUS environment to act as an on-line and off-line filter for the raw data from MPS II and ISABELLE experiments.

28342 (CERN—81-07, pp 488-494) **Application of the FAMP multiprocessor system in experiment NA11 at the SPS.** Hertzberger, L.O.; Hoogland, W.; Wiggers, L.W. (Nationaal Inst. voor Kernfysica en Hoge-Energiefysica (NIKHEF), Amsterdam (Netherlands)). 17 Jul 1981. Dep. NTIS (US Sales Only).

From Conference on the application of microprocessors to high energy physics experiments; Geneva, Switzerland (4 May 1981).

A second level trigger system is discussed which will be implemented in the experiment NA 11 at the CERN-SPS. The experiment studies hadron interactions with a two magnet single-arm spectrometer. The second level trigger will select events depending on kinematical and topological conditions. It uses the FAMP microprocessor system, which will operate on information from a set of MWPC's and Cherenkov counters. The microprocessors will reconstruct tracks, calculate momenta, and determine the invariant mass of pairs of particles. An outline will be given of the trigger set-up and of the track reconstruction procedures. Also results will be presented of simulation studies, using experimental data and a

provisional set-up of the microprocessor system. The reconstruction time per event is estimated to be about .5 msec.

28343 (CERN—81-07, pp 495-499) **Original approach to data acquisition: CHADAC.** Huppert, M.; Nayman, P.; Rivoal, M. (Paris-11 Univ., 91 - Orsay (France). Lab. de Physique Nucleaire et Hautes Energies). 17 Jul 1981. Dep. NTIS (US Sales Only).

From Conference on the application of microprocessors to high energy physics experiments; Geneva, Switzerland (4 May 1981).

Many labs try to boost existing data acquisition systems by inserting high performance intelligent devices in the important nodes of the system's structure. This strategy finds its limits in the system's architecture. The CHADAC project proposes a simple and efficient solution to this problem, using a multiprocessor modular architecture. CHADAC main features are: (a) Parallel acquisition of data: CHADAC is fast; it dedicates one processor per branch; each processor can read and store one 16 bit word in 800 ns. (b) Original structure: each processor can work in its own private memory, in its own shared memory (double access) and in the shared memory of any other processor (this feature being particulary useful to avoid wasteful data transfers). Simple and fast communications between processors are also provided by local DMA'S. (c) Flexibility: each processor is autonomous and may be used as an independent acquisition system for a branch, by connecting local peripherals to it. Adjunction of fast trigger logic is possible. By its architecture and performances, CHADAC is designed to provide a good support for local intelligent devices and transfer operators developed elsewhere, providing a way to implement systems well fitted to various types of data acquisition.

28344 (CERN—81-07, pp 500) **On-line event filtering using the 168/E in CERN experiment NA4.** Bogaerts, A.; Brun, R.; Eck, C.; Lacourt, A.; Rothan, B.; Ogilvie, J.; Overas, H.; Petersen, J.O. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). 17 Jul 1981. Dep. NTIS (US Sales Only).

From Conference on the application of microprocessors to high energy physics experiments; Geneva, Switzerland (4 May 1981).

28345 (CERN—81-07, pp 501-514) **On-line experience with the 168/E.** Carroll, J.T.; Brau, J.E.; Maruyama, T.; Parker, D.B. (Stanford Linear Accelerator Center, CA (USA)); Chima, J.S.; Price, D.R.; Rankin, P. (Imperial Coll. of Science and Technology, London (UK)); Hatley, R.W. (Science Research Council, Chilton (UK). Rutherford and Appleton Labs.). 17 Jul 1981. Dep. NTIS (US Sales Only).

From Conference on the application of microprocessors to high energy physics experiments; Geneva, Switzerland (4 May 1981).

Current 20 GeV/c photoproduction experiments at the SLAC Hybrid Facility require a decision to take a picture within 150-300 μs after the beam pulse. A charged track trigger is provided by a 168/E processor which finds tracks in a downstream PWC system. To meet trigger time requirements the 168/E SNOOP module CAMAC interface is augmented by a CAMAC auxiliary Controller and dedicated I/0 cards in the 168/E chassis. Between beam pulses a floating point Fortran program executing on a 168/E monitors data acquisition. Experience with software development and application are reviewed.

28346 (CERN—81-07, pp 515-521) **GA103: a microprogrammable processor for online filtering.** Calzas, A.; Danon, G.; Bouquet, B. (Ecole Normale Superieure, 91 - Orsay (France). Lab. de l'Accelerateur Lineaire). 17 Jul 1981. Dep. NTIS (US Sales Only).

From Conference on the application of microprocessors to high energy physics experiments; Geneva, Switzerland (4 May 1981).

GA 103 is a 16 bit microprogrammable processor which emulates the PDP 11 instruction set. It is based on the Am 2900 slices. It allows user-implemented microinstructions and addition of hardwired processors. It will perform on-line filtering tasks in the NA 14 experiment at CERN, based on the reconstruction of transverse momentum of photons detected in a lead glass calorimeter.

28347 (CERN—81-07, pp 522-525) **Transfer of monitor tasks from data taking PDP to microprocessors.** Bell, W.; Forlini, L.; Tisserand, F. 17 Jul 1981. Dep. NTIS (US Sales Only).

From Conference on the application of microprocessors to high energy physics experiments; Geneva, Switzerland (4 May 1981).

With the introduction of microprocessors, monitor tasks normally run as background jobs on main computers, can now be done on cheap dedicated systems with a considerable improvement in speed. An example is described which continuously wiremaps the 70,000 wires in the SFM MWPC detector. A M 6800 microprocessor is used as a spy module on data transfers to the PDP 11/45 and chambers are sequentially wiremapped during data taking. Features include a shared memory switched to 16 bit mode for event spying and 8 bit for processing. Hardware address pointers assist in locating required chamber data in the (typical) 2 k data blocs. Program is stored in 4 k of ROM with automatic bootstrap enabling immediate use after power on. Also in ROM are chamber characteristics to enable missing wire diagnosis. 32 k of RAM is used as working space. All user communication is via 8 pushbuttons, histograms can be displayed during accumulation and final hardcopies are output on the PDP electrostatic printer/plotter (shared mode) along with a list of missing wires. Programming effort for the entire project was supplied by a CERN summer student.

28348 (CERN—81-07, pp 526-531) **UA1 monitor readout.** Cawthraw, M.; Chilvers, A. (Science Research Council, Chilton (UK). Rutherford and Appleton Labs.). 17 Jul 1981. Dep. NTIS (US Sales Only).

From Conference on the application of microprocessors to high energy physics experiments; Geneva, Switzerland (4 May 1981).

The Trigger electronics for the UA1 proton-antiproton experiment at CERN is large and complex. A trigger Monitor containing 640 registers is used to take what is in effect a snapshot of the total state of the trigger as it processes an event. The Monitor's dead time is reduced by quickly reading the content of its registers into buffer memory located in both CAMAC and Remus systems. The CAMAC-computer system emulates the Trigger's calculations and is used to sample and check if the Trigger is working correctly. The Remus system is used for the recording of good-event data and to this end reads in the state of the Trigger as a small part of this data. The readout of the 640 registers into memory followed by the readout of memory into CAMAC and REMUS systems is largely organised by a MC 6800 microprocessor. The task is simple but achieving sufficient speed is not. Speed is achieved by minimising the number of microprocessor instructions eg. data does not pass through the CPU or its memory and program counting loops are replaced by either hardware counters or the stored repetition of the required number of instructions.

28349 (CERN—81-07, pp 532) **Small microprocessor based CAMAC module for testing and monitoring purposes.** Bouquet, B.; Caalot, O.; Ngoc, H.N. (Ecole Normale Superieure, 91 - Orsay (France). Lab. de l'Accelerateur Lineaire). 17 Jul 1981. Dep. NTIS (US Sales Only).

From Conference on the application of microprocessors to high energy physics experiments; Geneva, Switzerland (4 May 1981).

28350 (CERN—81-07, pp 544) **CAMAC logic state analyser.** Centro, S.; Cittolin, S. 17 Jul 1981. Dep. NTIS (US Sales Only).

From Conference on the application of microprocessors to high energy physics experiments; Geneva, Switzerland (4 May 1981).

28351 (CERN—81-07, pp 545-556) **Microcomputer network for the control of digitizing machines.** Seller, P. (Science Research Council, Chilton (UK). Rutherford and Appleton Labs.). 17 Jul 1981. Dep. NTIS (US Sales Only).

From Conference on the application of microprocessors to high energy physics experiments; Geneva, Switzerland (4 May 1981).

A distributed microcomputing network operates in the Bubble Chamber Research Group Scanning Laboratory at the Rutherford and Appleton Laboratories. A microcomputer at each digitising table buffers information, controls the functioning of the table and enhances the machine/operator interface. The system consists of fourteen microcomputers together with a VAX 11/780 computer used for data analysis. These are inter-connected via a packet switched network. The features of the combined system are described, including the distributed computing architecture and the packet switched method of communication. A high speed packet switching controller used as a central node of the network is described in detail. This controller is a multiprocessor microcomputer system with eighteen central processor units, thirty-four direct memory access channels and thirty-four prioritorized and vectored interrupt channels. This microcomputer is of general interest as a communications controller due to its totally programmable nature.

28352 (CERN—81-07, pp 557-561) **Automation of BESSY scanning tables.** Hanton, J.; Kesteman, J. (Mons Univ. (Belgium)). 17 Jul 1981. Dep. NTIS (US Sales Only).

From Conference on the application of microprocessors to high energy physics experiments; Geneva, Switzerland (4 May 1981).

A micro processor M6800 is used for the automation of scanning and premeasuring BESSY tables. The tasks achieved by the micro processor are: (1) control of spooling of the four asynchronous film winding devices and switching on and off the 4 projections lamps, (2) pre-processing of the data coming from a bi-polar coordinates measuring device, (3) bi-directional interchange of informations between the operator, the BESSY table and the DEC PDP 11/34 mini computer controlling the scanning operations, and (4) control of the magnification on the table by swapping the projection lenses of appropriate focal lengths and the associated light boxes (under development). In connection with point 4, study is being made for the use of BESSY tables for accurate measurements (+-5 microns), by encoding the displacements of the projections lenses.

28353 (CERN—81-07, pp 573-578) **High speed serial link for UA1 microprocessor network.** Cittolin, S.; Loefstedt, B.; Zurfluh, E. 17 Jul 1981. Dep. NTIS (US Sales Only).

From Conference on the application of microprocessors to high energy physics experiments; Geneva, Switzerland (4 May 1981).

The UA1 data acquisition system consists of a set of distributed microprocessor units. An interprocessor link, independent of the CAMAC data readout, has been developed in order to have continuous remote control and run-time data handling, e.g. transmission of calibration programs/parameters, equipment rest/status and histogram accumulation. The data transmission system is designed to be used in a loop configuration equipped with transceivers for twisted pair cables (RS-422). As an economical system it is running as an ancillary serial loop-link between microprocessors Like Data Acquisition Crate Controllers and systems with distributed intelligence. The software driver consists of a loop-controller package, which may run in a BAMBI Computer Language environment and a fully interrupt controlled program for all other secondary stations. A special single-character mode provides a handy link for remote debugging in a pseudo-full-duplex mode. The format is based on the HDLC protocol without sequence numbering. The Chip MC-6854 from Motorola, Inc. enables an implementation with few components.

28354 (CERN—81-07, pp 124-131) **Fast on-line event reconstruction procedure based on a linearized least-squares fit.** Aprile, E.; Hausammann, R.; Heer, E.; Hess, R.; Lechanoine-Leluc, C.; Leo, W.R.; Morenzoni, S.; Onel, Y.; Rapin, D. (Geneva Univ. (Switzerland). Dept. de Physique Nucleaire et Corpusculaire). 17 Jul 1981. Dep. NTIS (US Sales Only).

From Conference on the application of microprocessors to high energy physics experiments; Geneva, Switzerland (4 May 1981).

We have developed and implemented a procedure suited for fast on-line reconstruction of particle physics events, in particular events with twobody final states, which are detected by a set-up consisting of triggering counters, multiwire proportional chambers and a polarized target (implying a strong magnetic field). The parameter vector describing the event is obtained from the vector of observations (MWPC coordinates) by multiplication with a reconstruction matrix, which is the pseudoinverse of the design matrix, obtained by a standard least-squares technique. A goodness-of-fit parameter (chi-square) is computed at the same time and allows testing of various reaction hypotheses and discrimination against background. The design matrix, which models the experiment in a linear approximation is obtained beforehand on a large computer. On-line reconstruction is then performed on events satisfying the desired trigger condition and having successfully passed tests made on the MWPC coordinates by a fast decision logic. The reconstruction is performed by a dedicated minicomputer and consists of alignment checks in individual telescopes, substitution of missing coordinates, computation of the various parameters describing the event, application of a correction to compensate for non-linearities in the relation between observations and parameters, and tallying of good events in multidimensional histograms to be transferred periodically to the computer PDP-11 controlling the entire experiment.

28355 (CERN—81-09, pp 44-46) **Dye laser-cryogenic helium jet system and recoil-mass-separator for studies of nuclei far from stability.** Clark, D.L.; Martin, A.G.; Nicolis, N.G.; Banerjee, S.; Cormier, T.M.; Stwertka, P.M.; Lin, B.S.; Hermann, M.G. (Rochester Univ., NY (USA). Nuclear Structure Research Lab.). 20 Jul 1981. Dep. NTIS (US Sales Only).

From 4. international conference on nuclei far from stability; Helsignor, Denmark (7 Jun 1981).

At NSRL we have in the final stages of development an on-line laser spectroscopy system for the upgraded MP tandem. The system is based on the use of more selective heavy-ion reactions so that mass separation is not usually required, and very sensitive detection techniques so that measurements are possible with small fluxes of atoms. A recoil mass separator is also near completion and will be used for a variety of studies of nuclei far from stability, including providing, when necessary, mass separated reaction products for study using the laser system. The heavy ion beam energy available from the upgraded MP allows production of neutron deficient nuclei by means of fusion-evaporation reactions that is limited only by the onset of charge particle evaporation, not beam energy.

28356 (CERN—81-09, pp 115) **Precision mass measurements.** Koslowsky, V.T.; Azuma, R.E.; Clifford, E.T.H. (Toronto Univ., Ontario (Canada). Dept. of Physics); Hardy, J.C.; Ball, G.C.; Davies, W.G.; Schmeing, H.; Schrewe, U.J.; Sharma, K.S. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.); Hagberg, E. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs. 20 Jul 1981. Dep. NTIS (US Sales Only).

From 4. international conference on nuclei far from stability; Helsignor, Denmark (7 Jun 1981).

A new technique analogous to the 'peak-matching' method used by mass spectroscopists is being used to measure differences in reaction Q-values to a precision of 100 eV. While at present the method is being applied to the study of charge-dependent corrections in $T = 1$ superallowed $0^+ \rightarrow 0^+$ beta-decay matrix elements, it could easily be extended to measure mass differences of nuclei farther from beta stability.

28357 (CERN—81-09, pp 141-147) **Precision mass measurements utilizing beta endpoints.** Moltz, D.M.; Toth, K.S. (Oak Ridge National Lab., TN (USA)); Avignone, F.T. III.; Noma, H.; Ritchie, B.G. (South Carolina Univ., Columbia (USA)); Kern, B.D. (Kentucky Univ., Lexington (USA)). 20 Jul 1981. Dep. NTIS (US Sales Only).

From 4. international conference on nuclei far from stability; Helsignor, Denmark (7 Jun 1981).

A technique for precise determination of beta endpoints with an intrinsic germanium detector has been developed. The energy calibration was derived from γ-ray photopeak measurements. This analysis procedure has been checked with a ^{27}Si source produced in a (p,n) reaction on an ^{27}Al target and subsequently applied to mass separated samples of ^{76}Rb, ^{77}Rb and ^{78}Rb. Results indicate errors < 50 keV are obtainable.

28358 (CERN—81-09, pp 42-46) **On-line laser spectroscopy at the Argonne superconducting linac.** Davids, C.N. (Argonne National Lab., IL (USA)); Greenlees, G.W.; Finn, M.A. (Minnesota Univ., Minneapolis (USA)); Lewis, D.A.; Evans, R.M. (Iowa State Univ. of Science and Technology, Ames (USA)). 20 Jul 1981. Dep. NTIS (US Sales Only).

From 4. international conference on nuclei far from stability; Helsignor, Denmark (7 Jun 1981).

This project, a collaboration between Argonne National Laboratory, Iowa State University, and the University of Minnesota, will use on-line laser spectroscopy to study the optical hyperfine structure of radioactive atoms. The objective is to extract information on spins, moments, and the variation of charge radii for ground states and isomers. The species under investigation will be produced by heavy-ion beams from the Argonne superconducting linac. The radioactive atoms recoil from the production target, become thermalized in a helium atmosphere, and then are transported by a liquid-nitrogen-cooled helium jet to the laser interaction region. Resonance fluorescence spectroscopy will be employed to observe the optical transitions. Essentially Doppler-free linewidths will be obtained by collimating the atoms into an atomic beam as they emerge from the helium jet. Two cooled photomultiplier tubes will detect the fluorescent light.

28359 (INIS-mf—6819, pp 422) **Spectrometers for nuclear reaction heavy products.** Noibert, V.; Maidikov, V.Z.; Surovitskaya, N.T.; Gofman, Yu.V.; Nemets, O.F.; Skobelev, N.K. 1981. (In Russian). Dep. NTIS (US Sales Only).

From 31. conference on nuclear spectroscopy and nuclear structure; Samarkand, USSR (14 Apr 1981).

28360 (INIS-mf—6819, pp 423) **Fast electromagnetic mass separator of recoils.** Gangrskii, Yu.P.; Markov, B.N.; Miller, M.B.; Pleve, A.A.; Kharisov, I.F. 1981. (In Russian). Dep. NTIS (US Sales Only).

From 31. conference on nuclear spectroscopy and nuclear structure; Samarkand, USSR (14 Apr 1981).

28361 (INIS-mf—6819, pp 427) **(E,ΔE)-spectrometer for studying the (n,z) fast neutron nuclear reactions.** Klochkova, L.I.; Kovrigin, B.S.; Kuritsyn, V.N. 1981. (In Russian). Dep. NTIS (US Sales Only).

From 31. conference on nuclear spectroscopy and nuclear structure; Samarkand, USSR (14 Apr 1981).

28362 (INIS-mf—6819, pp 431) **Mass separation of light charged particles in a wide energy range.** Gorpinich, O.K.; Kadkin, E.P.; Kondrat'ev, S.N. 1981. (In Russian). Dep. NTIS (US Sales Only).

From 31. conference on nuclear spectroscopy and nuclear structure; Samarkand, USSR (14 Apr 1981).

28363 (INIS-mf—6819, pp 432) **System for semultaneous studying of correlations between charged particles of different types.** Pasechnik, M.V.; Badovskii, V.P.; Gorpinich, O.K.; Kadkin, E.P.; Kondrat'ev, S.N.; Ofengenden, R.G.; Palkin, G.P.; Saltykov, L.S.; Svetlichnyi, P.N.; Tokarevskii, V.V. 1981. (In Russian). Dep. NTIS (US Sales Only).

From 31. conference on nuclear spectroscopy and nuclear structure; Samarkand, USSR (14 Apr 1981).

28364 (INIS-mf—6819, pp 433) **Accuracy of coordinate determination by a spark sonic chamber used in a magnetic spectrograph.** Solin, L.M.; Kuz'min, V.N.; Nemilov, Yu.A. 1981. (In Russian). Dep. NTIS (US Sales Only).

From 31. conference on nuclear spectroscopy and nuclear structure; Samarkand, USSR (14 Apr 1981).

28365 (INIS-mf—6819, pp 434) **dE/dx thin detectors on the base of epitaxial silicon structures.** Ganza, E.A. 1981. (In Russian). Dep. NTIS (US Sales Only).

From 31. conference on nuclear spectroscopy and nuclear structure; Samarkand, USSR (14 Apr 1981).

28366 (INIS-mf—6819, pp 435) **Position-sensitive shower detector with a resistive electrode.** Donichkin, A.G.; Shigaev, O.E. 1981. (In Russian). Dep. NTIS (US Sales Only).

From 31. conference on nuclear spectroscopy and nuclear structure; Samarkand, USSR (14 Apr 1981).

28367 (INIS-mf—6819, pp 435) **Two-arm time-of-flight spectrometer of fission fragments.** Aleksandrov, A.A.; Byalko, A.A.; Volkov, N.G. 1981. (In Russian). Dep. NTIS (US Sales Only).

From 31. conference on nuclear spectroscopy and nuclear structure; Samarkand, USSR (14 Apr 1981).

28368 (INIS-mf—6819, pp 436) **Determining the resolution of a spark sonic chamber used in a magnetic spectrograph.** Solin, L.M.; Kuz'min, V.N.; Nemilov, Yu.A. 1981. (In Russian). Dep. NTIS (US Sales Only).

From 31. conference on nuclear spectroscopy and nuclear structure; Samarkand, USSR (14 Apr 1981).

28369 (INIS-mf—6819, pp 437) **Position sensitive chamber for proton detection in a magnetic spectrograph.** Koblik, Yu.N.; Mazitov, B.S.; Yakushev, V.P. 1981. (In Russian). Dep. NTIS (US Sales Only).

From 31. conference on nuclear spectroscopy and nuclear structure; Samarkand, USSR (14 Apr 1981).

28370 (INIS-mf—6819, pp 438) **Application of Si semiconductor detectors at electron linear accelerators.** Likhachev, V.P.; Vladimirov, Yu.V.; Denyak, V.M. 1981. (In Russian). Dep. NTIS (US Sales Only).

From 31. conference on nuclear spectroscopy and nuclear structure; Samarkand, USSR (14 Apr 1981).

28371 (INIS-mf—6819, pp 542) **Some specific features of spectroscopy of Compton backscattering of γ-quanta in axial geometry.** Rad'ko, V.E. 1981. (In Russian). Dep. NTIS (US Sales Only).

From 31. conference on nuclear spectroscopy and nuclear structure; Samarkand, USSR (14 Apr 1981).

28372 (INIS-mf—6819, pp 543) **Axial spectrometer of backward Compton scattering.** Rad'ko, V.E.; Mokrushin, A.D.; Razumovskaya, I.V. 1981. (In Russian). Dep. NTIS (US Sales Only).

From 31. conference on nuclear spectroscopy and nuclear structure; Samarkand, USSR (14 Apr 1981).

28373 (INIS-mf—6819, pp 560) **Equipment for studying gamma spectra at electron channeling in a diamond monocrystal in the 1-10³ MeV range.** Adishchev, Yu.N.; Zabaev, V.N.; Kalinin, B.N.; Potylitsyn, A.P.; Tomchakov, V.K. 1981. (In Russian). Dep. NTIS (US Sales Only).

From 31. conference on nuclear spectroscopy and nuclear structure; Samarkand, USSR (14 Apr 1981).

28374 (INIS-mf—6819, pp 571) **Application of FEU-139 in scintillation gamma cameras.** Kalashnikov, S.D.; Krivoshein, V.L. 1981. (In Russian). Dep. NTIS (US Sales Only).

From 31. conference on nuclear spectroscopy and nuclear structure; Samarkand, USSR (14 Apr 1981).

28375 (INIS-mf—6819, pp 573) **Computer optimization of a gamma camera detector.** Kalashnikov, S.D.; Markovski, A.E. 1981. (In Russian). Dep. NTIS (US Sales Only).

From 31. conference on nuclear spectroscopy and nuclear structure; Samarkand, USSR (14 Apr 1981).

28376 (INIS-mf—6819, pp 577) **Analysis of the effect of track finite width of a heavy charged particle on the readings of a gas-filled spherical detector of the ΔE-spectrometer.** Kut'kov, V.A.; Bunina, E.F. 1981. (In Russian). Dep. NTIS (US Sales Only).

From 31. conference on nuclear spectroscopy and nuclear structure; Samarkand, USSR (14 Apr 1981).

28377 (INIS-mf—6819, pp 578) **Energy dependence of the solid-state detector sensitivity.** Baranov, V.F.; Demin, V.M.; Smirnov, V.V. 1981. (In Russian). Dep. NTIS (US Sales Only).

From 31. conference on nuclear spectroscopy and nuclear structure; Samarkand, USSR (14 Apr 1981).

28378 (INIS-mf—6819, pp 579) **Using several detecting complexes in applied problems of nuclear spectroscopy.** Stolyarova, E.L.; Novikov, A.I.; Srapenyants, R.A.; Chelyshev, V.A. 1981. (In Russian). Dep. NTIS (US Sales Only).

From 31. conference on nuclear spectroscopy and nuclear structure; Samarkand, USSR (14 Apr 1981).

28379 (INIS-mf—6819, pp 580) **Approximation of cascade curves in lead glasses.** Belousov, A.S.; Kitaev, D.F.; Malinovskii, E.I.; Samedov, V.V.; Stolyarova, E.L.; Solov'ev, Yu.V.; Vazdik, Ya.A. 1981. (In Russian). Dep. NTIS (US Sales Only).

From 31. conference on nuclear spectroscopy and nuclear structure; Samarkand, USSR (14 Apr 1981).

28380 (INIS-mf—6819, pp 581) **Calculation of the signal amplitude at the output of a shower spectrometer.** Belousov, A.S.; Vazdik, Ya.A.; Kitaev, D.F.; Malinovskii, E.A.; Samedov, V.V.; Stolyarova, E.L.; Solov'ev, Yu.V. 1981. (In Russian). Dep. NTIS (US Sales Only).

From 31. conference on nuclear spectroscopy and nuclear structure; Samarkand, USSR (14 Apr 1981).

28381 (INIS-mf—6819, pp 605) **Technique for definition of a photopeak position in the presence of background.** Fishman, L.Ya.; Kostylev, V.A. 1981. (In Russian). Dep. NTIS (US Sales Only).

From 31. conference on nuclear spectroscopy and nuclear structure; Samarkand, USSR (14 Apr 1981).

28382 (INIS-mf—6819, pp 614) **Improvement of the main performances of a 4 m crystal-diffraction gamma spectrometer.** Alekseev, V.L.; Leushkin, E.K.; Rumyantsev, V.L.; Samsonov, V.M. 1981. (In Russian). Dep. NTIS (US Sales Only).

From 31. conference on nuclear spectroscopy and nuclear structure; Samarkand, USSR (14 Apr 1981).

28383 (INIS-mf—6819, pp 615) **Solid-state spectrometer for charged particles.** Kugatova, F.U.; Muminov, R.A.; Yafasov, A.Ya. 1981. (In Russian). Dep. NTIS (US Sales Only).

From 31. conference on nuclear spectroscopy and nuclear structure; Samarkand, USSR (14 Apr 1981).

28384 (INIS-mf—6819, pp 616) **Using ion implantation in technology of nuclear radiation semiconductor detectors.** Gogitidze, N.Z.; Krasnopevtsev, V.V.; Sokol, G.A. 1981. (In Russian). Dep. NTIS (US Sales Only).

From 31. conference on nuclear spectroscopy and nuclear structure; Samarkand, USSR (14 Apr 1981).

28385 (INIS-mf—6819, pp 617) **Spectrometric capabilities of the detectors with compressed xenon.** Dmitrenko, V.V.; Romanyuk, A.S.; Uteshev, Z.M. 1981. (In Russian). Dep. NTIS (US Sales Only).

From 31. conference on nuclear spectroscopy and nuclear structure; Samarkand, USSR (14 Apr 1981).

28386 (INIS-mf—6819, pp 622) **Fast responce device for rare events spectrometry in heavy ion beam.** Bogdanov, D.D.; Vakatov, V.I.; Ivanov, M.P.; Popeko, G.S.; Rodin, A.M.; Ter-Akop'yan, G.M. 1981. (In Russian). Dep. NTIS (US Sales Only).

From 31. conference on nuclear spectroscopy and nuclear structure; Samarkand, USSR (14 Apr 1981).

28387 (INIS-mf—6819, pp 623) **Study on low-energy electrons at a beta spectrograph.** Abdurazakov, A.A.; Gromov, K.Ya.; Islamov, T.A.; Kononenko, G.A.; Lebedev, N.A.; Tangabaev, A.A.; Kholmatov, A.Kh. 1981. (In Russian). Dep. NTIS (US Sales Only).

From 31. conference on nuclear spectroscopy and nuclear structure; Samarkand, USSR (14 Apr 1981).

28388 (INIS-mf—6819, pp 628) **Total-absorption gamma spectrometer for measuring β-decay strength functions on-line with the "IRIS" separator.** Bykov, A.A.; Vitman, V.D.; Naumov, Yu.V.; Orlov, S.Yu. 1981. (In Russian). Dep. NTIS (US Sales Only).

From 31. conference on nuclear spectroscopy and nuclear structure; Samarkand, USSR (14 Apr 1981).

28389 (INIS-mf—6819, pp 629) **Installation for study on nuclear excitation by means of the effect of electron-positron pair production.** Novikov, Yu.A.; Piskarev, I.M. 1981. (In Russian). Dep. NTIS (US Sales Only).

From 31. conference on nuclear spectroscopy and nuclear structure; Samarkand, USSR (14 Apr 1981).

28390 (INIS-mf—6819, pp 630) **Channel surface barrier silicon detector.** Leshaev, S.I.; Solov'ev, S.M.; Soloshenkov, P.S. 1981. (In Russian). Dep. NTIS (US Sales Only).

From 31. conference on nuclear spectroscopy and nuclear structure; Samarkand, USSR (14 Apr 1981).

28391 (INIS-mf—6819, pp 631) **dE/dx detectors based on epitaxyal silicon structures.** Evseev, I.I.; Kryachko, V.V.; Didenko, A.A. 1981. (In Russian). Dep. NTIS (US Sales Only).

From 31. conference on nuclear spectroscopy and nuclear structure; Samarkand, USSR (14 Apr 1981).

28392 (INIS-mf—6819, pp 633) **Specific features of semiconductor detector using at the liquid helium temperature.** Afanas'eva, N.P.; Eremin, V.K.; Strokan, N.B.; Shamagdiev, A.Sh. 1981. (In Russian). Dep. NTIS (US Sales Only).

From 31. conference on nuclear spectroscopy and nuclear structure; Samarkand, USSR (14 Apr 1981).

28393 (INIS-mf—6819, pp 634) **Study on the spectrometric characteristics of dE/dx detectors.** Malaeva, V.T.; Muminov, R.A.; Yafasov, A.Ya. 1981. (In Russian). Dep. NTIS (US Sales Only).

From 31. conference on nuclear spectroscopy and nuclear structure; Samarkand, USSR (14 Apr 1981).

28394 (INIS-mf—6819, pp 635) **Ion-doped detectors with high energy resolution and its application in the elemental analysis.** Sokhoreva, V.V.; Cherdantsev, Yu.P. 1981. (In Russian). Dep. NTIS (US Sales Only).

From 31. conference on nuclear spectroscopy and nuclear structure; Samarkand, USSR (14 Apr 1981).

28395 (INIS-mf—6819, pp 637) **Effect of the (μ-e) spectrometer timing properties on the instrument spectrum.** Mel'nichuk, V.P.; Miloserdin, V.Yu.; Svirida, S.V.; Smilga, V.P. 1981. (In Russian). Dep. NTIS (US Sales Only).

From 31. conference on nuclear spectroscopy and nuclear structure; Samarkand, USSR (14 Apr 1981).

28396 (INIS-mf—6819, pp 639) **Multielectrode ionization spectrometer for heavy ions.** Semenov, Yu.V.; Fedorchukov, S.D.; Chernyshev, B.A. 1981. (In Russian). Dep. NTIS (US Sales Only).

From 31. conference on nuclear spectroscopy and nuclear structure; Samarkand, USSR (14 Apr 1981).

28397 (INIS-mf—6819, pp 650) **Measuring the efficiency of gamma detection by microchannel plates.** Ajnbund, M.R.; Grudskii, M.Ya.; Gussar, V.A.; Kumzerov, S.A.; Maslenkov, I.P.; Mortikov, Yu.V.; Roldugin, N.N.; Smirnov, V.V. 1981. (In Russian). Dep. NTIS (US Sales Only).

From 31. conference on nuclear spectroscopy and nuclear structure; Samarkand, USSR (14 Apr 1981).

28398 (INIS-mf—6819, pp 658) **To the problem of amplitude spectrum formation by Si(Li) beta spectrometers.** Zaveryukhin, B.N.; Ismailov, Kh.Kh.; Mikeeva, Z.; Muminov, R.A.; Yafasov, A.Ya. 1981. (In Russian). Dep. NTIS (US Sales Only).

From 31. conference on nuclear spectroscopy and nuclear structure; Samarkand, USSR (14 Apr 1981).

28399 (INIS-mf—6819, pp 567) **Time expander for correlation measurements.** Klyucharev, V.A. 1981. (In Russian). Dep. NTIS (US Sales Only).

From 31. conference on nuclear spectroscopy and nuclear structure; Samarkand, USSR (14 Apr 1981).

28400 (INIS-mf—6819, pp 620) **Technique for measuring (β-e) asymmetry and anisotropy.** Aldushchenkov, A.V. 1981. (In Russian). Dep. NTIS (US Sales Only).

From 31. conference on nuclear spectroscopy and nuclear structure; Samarkand, USSR (14 Apr 1981).

28401 (INIS-mf—6819, pp 642) **Universal chamber for element analysis by backscattering.** Polevich, O.V.; Makarov, Yu.G.; Sarana, V.D.; Koshchii, E.I. 1981. (In Russian). Dep. NTIS (US Sales Only).

From 31. conference on nuclear spectroscopy and nuclear structure; Samarkand, USSR (14 Apr 1981).

28402 (INIS-mf—6819, pp 643) **To the problem of photomultiplier amplitude instability.** Grantsev, V.I.; Dryapachenko, I.P.; Kornilov, V.A.; Konfederatenko, V.I.; Rudenko, B.A.; Sokolov, M.V.; Struzhko, B.G. 1981. (In Russian). Dep. NTIS (US Sales Only).

From 31. conference on nuclear spectroscopy and nuclear structure; Samarkand, USSR (14 Apr 1981).

28403 (INIS-mf—6819, pp 645) **Gamma spectrometric experiment planning by means of a simulator.** Gudkov, A.N.; Kolobashkin, V.M.; Morozova, N.I.; Taranenko, P.I.; Finogenov, K.G. 1981. (In Russian). Dep. NTIS (US Sales Only).

From 31. conference on nuclear spectroscopy and nuclear structure; Samarkand, USSR (14 Apr 1981).

28404 (INIS-mf—6819, pp 576) **Studying the methods for numerical decoding of images, obtained in a gamma camera by means of a Fresnel zone plate.** Fedorov, G.A.; Fishman, L.Ya.; Kosterev, V.V.; Artemov, I.V.; Dolzhikov, Yu.S.; Dmitriev, A.M. 1981. (In Russian). Dep. NTIS (US Sales Only).

From 31. conference on nuclear spectroscopy and nuclear structure; Samarkand, USSR (14 Apr 1981).

28405 (INIS-mf—6819, pp 618) **Approximation of calibration dependeces by orthonormalized polynomials.** Gadzhokov, V. 1981. (In Russian). Dep. NTIS (US Sales Only).

From 31. conference on nuclear spectroscopy and nuclear structure; Samarkand, USSR (14 Apr 1981).

28406 (INIS-mf—6819, pp 625) **Continuous magnetic recording of mass data while operating with minicomputer.** Lemberg, I.Kh.; Petrov, S.A. 1981. (In Russian). Dep. NTIS (US Sales Only).

From 31. conference on nuclear spectroscopy and nuclear structure; Samarkand, USSR (14 Apr 1981).

28407 (INIS-mf—6819, pp 647) **Quantitative evaluation of the peak identification confidence in line spectra.** Sotnikov, V.V.; Gopych, P.M. 1981. (In Russian). Dep. NTIS (US Sales Only).

From 31. conference on nuclear spectroscopy and nuclear structure; Samarkand, USSR (14 Apr 1981).

28408 (INIS-mf—6819, pp 648) **Calculation of the line spectrum peak identification confidence and comparison of the obtained results for an arbitrary number of experiments.** Sotnikov, V.V.; Gopych, P.M.; Zalyubovskii, I.I. 1981. (In Russian). Dep. NTIS (US Sales Only).

From 31. conference on nuclear spectroscopy and nuclear structure; Samarkand, USSR (14 Apr 1981).

28409 (INIS-mf—6819, pp 649) **Calculating the conditional probabilities of the line spectrum peak fault and true recognition based on the results of independent measurements series.** Gopych, P.M.; Zalyubovskii, I.I.; Sotnikov, V.V. 1981. (In Russian). Dep. NTIS (US Sales Only).

From 31. conference on nuclear spectroscopy and nuclear structure; Samarkand, USSR (14 Apr 1981).

28410 (INIS-mf—6819, pp 667) **Delayed solution method in parametrization of spectrometric problems of nuclear physics.** Kitaev, V.Ya. 1981. (In Russian). Dep. NTIS (US Sales Only).

From 31. conference on nuclear spectroscopy and nuclear structure; Samarkand, USSR (14 Apr 1981).

28411 (INIS-SU—39, pp 36-42) **Reactor gamma spectrum measuring by means of integral detectors.** Kramer-Ageev, E.A.; Tikhonov, E.G.; Troshin, V.S. 1980. (In Russian). Dep. NTIS (US Sales Only).

In Problems on dosimetry and radiation protection. No. 19.

The method of measuring γ radiation spectra in experimental devices of nuclear reactors at very high dose rates of gamma and neutron radiations are considered. A set of "wall" and vacuum ionization chambers with walls of aluminium, titanium, zirconium, tantalum and lead is used for measuring gamma radiation spectra. Reconstctruction of the gamma radiation spectra is performed by the directed divergence method. Calculation and experimental dependences of sensitivity functions of the used chambers on the gamma radiation energy are presented. The results of verification of the proposed method during spectra measurement of a reference field at the horizontal experimental channel output of the IRT-2000 reactor are considered. The reference field spectrum is measured using the "Compton mirror" method by a scintillation spectrometer with an organic scintillator. On the basis of the analysis of the results obtained the conclusion is made on working ability of the proposed method for measuring continuous spectra of the reactor gamma radiation in the 10^{-1}-10^{-4} rad/s dose rate range.

28412 (INIS-SU—39, pp 67-80) **Some achievements in developing the methods of spectrometry and radiometry of man radiations.** Fedorov, G.A.; Kosterev, V.V. 1980. (In Russian). Dep. NTIS (US Sales Only).

In Problems on dosimetry and radiation protection. No. 19.

A review of works on developing the measurement methods and constructions of man radiation spectrometers (MRS) is given. The measurement methods and methods of data processing permitting to reduce spatial inhomogeneity of MRS recording efficiency while using stationary multidetector geometries and scanning geometries, the methods of determining the spatial radionuclide distribution in a human body using MRS and MRS constructions with nonorganic and organic scintillation and semiconductor detectors realizing these methods are considered. Practical and calculation aspects of using the matrix method of activity determination and radionuclide distribution in the human body. It is noted that application of the weight calibration vector method in the presence of complex radionuclide mixtures and analysis of initial radiation is more effective if a semiconductor radiation detector (SRD) is used as a MRS measuring transformer. Utilization of the SRD in the MRS becomes expedient in connection with appearance of coaxial detectors with the approximately 100 cm^3 sensitivity volume. The conclusion is

made that the methods developed permit to increase the quantity and confidence of the data obtained. The error decrease while using traditional MRS is attained not only by calibration accuracy but mainly due to the reduction of the spatial recording inhomogeneity and minimization of the statistical error component while measuring small activities or by decreasing the minimum detected activity. The error decrease while determining radionuclide localization is attained by optimal planning of the experiment and optimal methods of the measurement data processing.

28413 (INIS-SU—57, pp 3-7) **Study of bremsstrahlung dose fields in radiation shield and labyrinth devices of plants with LUEH-8/5B accelerator.** Vikulin, A.A.; Vanyushkin, B.M.; Garnyk, D.V.; Kon'kov, N.G.; Terent'ev, B.M. 1980. (In Russian). Dep. NTIS (US Sales Only).

In Radiation techniques. Issue 19. Questions of nuclear science and techniques.

Measurement results of exposure dose rate (EDR) of radiation in fields of bremsstrahlung of radiation plants with LUEh-8/5B electron linear accelerator by means of DRG2-03 dose meter, intended for operative measuring EDR in high intense fields of γ-radiation of powerful radioisotopic plants, are presented. Dose meter design is described. Measurements of bremsstrahlung EDR have been carried out in the chamber of plant irradiation for radiation sterilizing medical items, as well as in the chamber of VNIIRT experimental plant. RUP-1 device has been used for measuring radiation EDR in a labyrinth behind 1.8 m thick shoulder by concrete.

28414 (INIS-SU—57, pp 95-104) **Rational choice of the nominal characteristic of radioisotope densimeter conversion.** Sobolevskii, A.E. 1980. (In Russian). Dep. NTIS (US Sales Only).

In Radiation techniques. Issue 19. Questions of nuclear science and techniques.

The problem of rational choice of nominal linear transformation characteristic, ascribed to non-linear measuring transformer of radioisotopic densimeter, is considered. Correlations for transition from the real exponential characteristic of densimeter transformation to nominal linear characteristic, melting the given requirements, are given. The obtained correlations determine the number of ranges in which the given measuring range should be divided.The error, caused by substitution of the present characteristic of transformation by the nominal one, would not exceed the stated limiting values.

28415 (INIS-SU—57, pp 81-89) **Effect of the detector angular dimensions on the instrumental angular distribution shape.** Mashinin, V.A.; Skachkov, E.V. 1980. (In Russian). Dep. NTIS (US Sales Only).

In Radiation techniques. Issue 19. Questions of nuclear science and techniques.

Relation between instrumental angular and real angular distributions of scattered narrow radiation beam depending on angular dimensions of a detector is obtained analytically. Calculations are carried out for point radiation source. Real angular distributions and instrumental angular distributions calculated by them, are given. The presented calculation results permit to evaluate characteristics of real distribution of scattered radiation by the known characteristics of instrumental distribution. Thus, for example, when at the angles THETA>THETAsub(D), where THETAsub(D) = angular dimensions of the detector, instrumental distribution is described by Gauss law, but real distribution - by gaussian.

28416 (INIS-SU—57, pp 90-95) **Operation of scintillation units with the large ratio of the detector area to the photomultiplier photocathode area.** Dubovenko, A.S.; Egorychev, D.V.; Pronkin, N.S. 1980. (In Russian). Dep. NTIS (US Sales Only).

In Radiation techniques. Issue 19. Questions of nuclear science and techniques.

Effect of different diameter relations of scintillation detectors and photomultipliers on counting characteristics of scintillation units within +-60 deg C temperature range for ^{137}Cs and ^{241}Am γ-radiation sources, is investigated. NaI(Tl)-detector of 30x40 mm size was used as a scintillation detector. NaI(Tl)-detector was connected with FEU-91 photomultiplier with 25 mm diameter of photocathode. A diaphragm, having 12, 20 and 25 mm internal diameters, was used for the change of photocathode square. Counting characteristics of scintillation units, operating within the temperature range from - 60 deg C up to +60 deg C, are presented. It is stated that worsening of counting characteristics of scintillation units is caused by signal drop in K times (K=Ssub(sd)/Ssub(pc), where Ssub(sd)=detector square, Ssub(pc)=photocathode square) and shifting of plateau beginning on ΔU=const lnK. Other reasons for worsening of counting characteristics of scintillation units at the presence of diaphragm are increase of photomultiplier noise ratio in the general noise of scintillation units and worsening of light collection conditions, that results in decrease of resolution of the scintillation unit. It is noted that conditions of scintillation unit operation with different relations of detector and photomultiplier diameter can be improved by means of light pipes permitting to improve light transmission from the detector to the photocathode.

28417 (INIS-SU—57, pp 21-25) **Calibration of film dosimeters by means of absorbed dose calorimeters.** Nikolaev, S.M.; Vanyushkin, B.M.; Kon'kov, N.G. 1980. (In Russian). Dep. NTIS (US Sales Only).

In Radiation techniques. Issue 19. Questions of nuclear science and techniques.

Methods of graduating film dosimeters by means of calorimeters of absorbed doses, are considered. Graduating of film dosimeters at the energies of accelerated electrons from 4 to 10 MeV can be carried out by means of quasiadiabatic calorimeter of local absorption, the absorber thickness of which should not exceed 5-10% of Rsub(e) value, where Rsub(e) = free electron path of the given energy. In this case film is located inside the calorimeter. For graduating films with thickness not less than (0.1-0.2)Rsub(e) it is suggested to use calorimeter of full absorption; then the graduated dosimeters are located in front of the calorimeter. Graduation of films at small energies of electrons is exercised by means of a package of films, approximately Rsub(e) thick. A design of quasiadiabatic calorimeter, intended for graduating dosimeters within the energy range of electron beam from 4 to 10 MeV, is considered. The quasiadiabatic calorimeter is a thin graphite tablet with heater and thermocouple, surrounded by foam plastic thermostating case. Electricity quantity, accumulated during the radiation field pass, is measured in the case of using the quasiadiabatic calorimeter for film graduating. The results of graduating film dosimeters, obtained using film package with Rsub(e) thickness, are presented. The obtained results coincide within 5% limits with the data known beforehand.

28418 (INIS-SU—57, pp 178-183) **Detection unit using the Si(Li)-semiconductor detector and thermoelectric refrigerator.** Vaigachev, A.A. 1980. (In Russian). Dep. NTIS (US Sales Only).

In Radiation techniques. Issue 19. Questions of nuclear science and techniques.

It is suggested that a modified detection unit with Si(Li)-detector and thermoelectric refrigerator should be used for multielement analysis. The head part of the detection unit, containing Si(Li)-detector, cold conductor, made of leucosapphire and field-effect transistor of preamplifier, is made in the form of a separate unit. This fact made it possible to approach maximal cooling of both the detector and field-effect transistor, as well as to reduce capacity of gate-case system to the minimum. Diameter of the head part is 19 mm, the height-20 mm. The aquare of sensitive surface of the detectors is 10-25 mm^2, and their thickness - 2.5-4mm. A charge-sensitive preamplifier, having conversion coefficient of 500 mW/MeV and energy equivalent of noises at the optimal temperature equal to 300 eV, is used in the detection unit. Temperature dependences of energy resolution and "peak-to-noise" parameter, measured within 80-200 K temperature range, are given. Analysis of the obtained results permits to conclude that energy resolution of Si(Li)-detectors essentially worsens at the temperatures of 170-190 K. It is explained by the fact that the design of the head part provides optimal conditions of cooling the detector and field-effect transistor at 140-170 K temperature. It is also stated that "peak-to-noise" parameter continuously decreases with temperature increase, beginning from 80 K, the nature of this dependence being determined by peculiarities of production technology of certain specimens of detectors. The detection unit on the base of Si(Li)-detector

and thermoelectric refrigerator provides energy resolution of 450 eV on MnKsub(α) line, and it can be successfully used in the X-ray radiometric analysis.

28419 (INIS-SU—57, pp 184-190) **Recording device for multi-channel x-ray radiometric analyzers.** Chuev, A.G.; Isaev, V.S.; Kuskova, N.V. 1980. (In Russian). Dep. NTIS (US Sales Only).

In Radiation techniques. Issue 19. Questions of nuclear science and techniques.

Arrangement and operation of automatic multichannel recording device, which exercises acquisition preliminary processing and information output on the M-6000 computer, is described. The automatic recoding device is intented for combined operation with 6-channel X-ray radiometric FRAM-1 analyzer, which permits to determine conditional concentrations of 6 components of the analyzed specimens during one measuring cycle. The recording device contains 6 counters, it corresponds to the number of analyzed elements, timer, units of information output on numerical indication, digital recorder of the BZ-15 type and M-6000 computer. The recording device is provided with intensimeter for the analyzer general tuning and for preliminary analysis of sample composition. The re or ing device makes it possible to measure simultaneously 6 counting rates of pulse consequences and relations of these rates. The recorder can operate in one of the following four regimes: automatic measurement of 6 counting rates by a given time, automatic measurement by a given set of pulses in the sixth channel, manual measurement and recorder control. Measuring time of the recording device changes within 10-1000 s range. Counting rate of input pulses is not less than 10^8 pul./s, the amplitude of input pulses constitutes 2.5-4.5 V. An experimental test of the recording device operation together with FRAM-1 analyzer proved correctness of the chosen electric scheme of the recording device.

28420 (INIS-SU—57, pp 190-195) **Device for measuring result printout for multi-channel x-ray radiometric analyzers.** Golovin, A.A.; Isaev, V.S.; Ulyakina, G.N.; Chuev, A.G. 1980. (In Russian). Dep. NTIS (US Sales Only).

In Radiation techniques. Issue 19. Questions of nuclear science and techniques.

An universal device for print out of measuring results from 6-channel X-ray radiometric FRAM-1 analyzer, is described. The main units of this device are control circuit of data print out, data print out unit on the digital printer BZ-15, dynamic indication unit, unit of output on digital indicators as well as the device of data output on M-6000 computer. Data output on digital display is carried out in manual regime, and information output on the BZ-15 printer and M-6000 computer can be exercised both manually and automatically. The device of data output is assembled on the base of unified functional units, that essentially simplifies construction of output devices on different number of channels and orders. Time of information output in decimal code in manual mode on digital indicators constitutes 20-30 s while time of information output in binary decimal code in automatic mode on M-6000 computer constitutes less than 1 s.

28421 (INIS-SU—57, pp 210-220) **Computer processing of thematic information files during development of the radiation technology devices.** Akopov, V.S.; Barinova, N.I.; Borisov, A.E.; Voronin, S.A.; Maiorov, A.N.; Meshalkin, I.A.; Orlov, N.S.; Khomchenkov, Yu.F.; Akopyan, Yu.G. 1980. (In Russian). Dep. NTIS (US Sales Only).

In Radiation techniques. Issue 19. Questions of nuclear science and techniques.

A complex, comprising four programs, is developed for computer processing of information sources during projecting items of radiation techniques. PATN1 program is intended for preliminary processing of the initial data file. PATN2 program is used for search of patent and scientific-technical information by codes of technical treatment. PATN3 program is applied for processing of expert evaluations, and PATN4 program is intended for processing of files of functional properties of technical parameters. Results of introducing a complex of programs at the stage of projecting is considered on the example of developing neutron flow detector. The suggested program complex can be used during developing hypothetical variants of new flaw-detector designs as well as for determination of functional possibilities of these designs and their consumer characteristics.

28422 (LBL—13213) **Low-noise preamplifiers/amplifiers for the Time-Projection Chamber.** Landis, D.A.; Adachi, R.S.; Madden, N.W.; Goulding, F.S. (Lawrence Berkeley Lab., CA (USA)). Oct 1981. Contract W-7405-ENG-48. 6p. (CONF-811012—30). NTIS, PC A02/MF A01. Order Number DE82003716.

From IEEE symposium on nuclear science; San Francisco, CA, USA (21 Oct 1981).

The special problems associated with the Time Projection Chamber resulted in the development of a new preamplifier/amplifier system which is discussed. The need for 16,000 channels of low noise electronics imposed serious constraints on the cost, size, and power consumption of the circuits. Also the preamplifiers are designed to work inside the detector chamber. This chamber operates at 10 atmosphere pressure and is sensitive both to the presence of magnetic materials that distort the drift field, and to the effects of gas contamination. These problems resulted in the use of new components and fabrication techniques. The large number of units involved requires automatic testing as discussed in the paper.

28423 (PB—81-857948) **Spark chambers. January 1972-December 1980 (citations from the International Aerospace Abstracts Data Base). Report for Jan 1972-Dec 1980.** (New England Research Application Center, Storrs, CT (USA)). Dec 1980. 165p. NTIS PC N01/MF N01.

Reports relating to research, studies, and applications of spark chambers in spectrometers, streamer chambers, optical telescopes, biomedical engineering, electronics, and physics are cited in this bibliography. Topics include wide gap spark chambers, high resolution cryogenic spark chambers and spark chambers for high magnetic fields. (Contains 171 citations, fully indexed and including a table of contents.)

28424 (PB—81-859076) **Bubble chamber observations and measurements of particle production. January 1970-December 1980 (citations from the Searchable Physics Information Notices Data Base). Report for Jan 1970-Dec 1980.** (New England Research Application Center, Storrs, CT (USA)). Feb 1981. 113p. NTIS PC N01/MF N01.

This retrospective bibliography contains citations concerning bubble chamber observations, identifications, and measurements of particle productions in interactions between various types of particles and between various types of currents, e.g., charged-current interactions and neutral-current interactions. Interpretations of experimental results and considerations of theoretical explanations for particle productions at various energy levels are included. (Contains 90 citations, fully indexed and including a table of contents.)

28425 (PNL—4100-Pt.4, pp 65-74) **Radiation instrumentation-radiological chemistry.** Feb 1982. NTIS, PC A06/MF A01.

In Pacific Northwest Laboratory annual report for 1981 to the DOE Office of Energy Research. Part 4. Physical sciences.

During the past year, major efforts in this program have concentrated on lowering the backgoround for the measurement of small amounts of radioactivity by beta and gamma counting, on the design of specialized systems, on specific procedures for the measurement of certain radionuclides, on improved computer programs for the analysis of gamma-ray spectral data, and on the development of X-ray fluorescence techniques that permit concentrations to be measured without the weight of the sample being known.

28426 (SLAC-PUB—2728-Rev.) **CAMAPPLE: CAMAC interface to the Apple computer.** Williams, S.H.; Oxoby, G.J.; Trang, Q.H. (Stanford Linear Accelerator Center, CA (USA)). Sep 1981. Contract AC03-76SF00515. 5p. (CONF-811012—35). NTIS, PC A02/MF A01. Order Number DE82003563.

From IEEE symposium on nuclear science; San Francisco, CA, USA (21 Oct 1981).

The advent of the personal microcomputer provides a new tool for the debugging, calibration and monitoring of small scale

physics apparatus; e.g., a single detector being developed for a larger physics apparatus. With an appropriate interface these microcomputer systems provide a low cost (1/3 the cost of a comparable minicomputer system), convenient, dedicated, portable system which can be used in a fashion similar to that of portable oscilloscopes. Here we describe an interface between the Apple computer and CAMAC which is now being used to study the detector for a Cerenkov ring-imaging device. The Apple is particularly well-suited to this application because of its ease of use, hi-resolution graphics peripheral buss and documentation support.

28427 **(VTT-ENT—27) Astacus. A reverse neutron time of flight diffractometer using a Fourier chopper.** Tiitta, A. (Valtion Teknillinen Tutkimuskeskus, Espoo (Finland)). 1980. 56p. NTIS, PC A04/MF A01.

A neutron diffractometer based on the reverse Fourier time of flight method and intended for the study of powdered samples is described. The Fourier chopper attains a maximum modulation frequency of 120 kHz, allowing a time resolution of about 10 microsec, depending on the frequency window employed. In the geometry, the time focusing principle is used to obtain high resolution. The lattice plane distances are resolved with a precision of Delta d/d 0.32% at d 1 A and Delta d/d 0.16% at 3.0 A. The diffractometer facility, its computer data acquisition hardware as well as the programs developed for controlling measurement and for acquiring and storing data are detailed. The performance of the facility was tested on a nickel powder sample, and the results of the profile refinement procedure for the measured diffraction patterns are given. The accuracy obtained for the lattice parameter determination is to 0.0001, and the room temperature value obtained for the Debye-Waller coefficient of nickel is B sub Ni 0.425 (+ or - 0.065) A squared. (ESA)

28428 **Fast, low-mass detector for charged particles.** McGlill, J.A.; Atencio, L.G.; Morris, C.L. (Los Alamos Scientific Lab., NM (USA). Meson Physics Facility). *Nuclear Instruments and Methods in Physics Research;* **188**: No. 3, 491-494(15 Oct 1981).

A multiwire proportional counter is described which yields time, position, and angle information. We report a measured time resolution of 2 ns fwhm, and an estimated position resolution of 0.1 mm.

28429 **Triangular tube proportional wire chamber system.** Badtke, D.H.; Bakken, J.A.; Barnett, B.A.; Blumenfeld, B.J.; Chien, C.Y.; Madansky, L.; Matthews, J.A.J.; Pevsner, A.; Spangler, W.J. (Johns Hopkins Univ., Baltimore, MD (USA)); Lee, K.L. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). *Nuclear Instruments and Methods in Physics Research;* **188**: No. 3, 497-506(15 Oct 1981).

We report on the characteristics of the proportional tube chamber system which has been constructed for muon identification in the PEP-4 experiment at SLAC. The mechanical and electrical properties of the extruded aluminum triangular tubes allow these detectors to be used as crude drift chambers.

28430 **Adapter for the Harshaw model 2000D TL analyzer system.** Gupta, V.P.; Cusimano, J.P. (Department of Energy, Idaho Falls, ID (USA). Idaho Operations Office); Parker, D. (EG and G Idaho, Inc., Idaho Falls (USA)). *Nuclear Instruments and Methods in Physics Research;* **188**: No. 3, 609-612(15 Oct 1981).

A potentially more versatile personnel radiation dosimetry badge, using TLD LiF-700 and LiF-600 chips, has been under development at the INEL. To read all four TLD chips from this badge without removing (or placing back after reading) one chip at a time, a unique adapter has been developed to provide the capability of reading chips in a Harshaw Model 2000D Automated TL Analyzer System. Only slight modification of the Harshaw Analyzer is required for using this adapter.

28431 **Nuclear radiation detectors. Chapter 6C.** Haller, E.E.; Goulding, F.S. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). pp 799-827 of Device physics. Hilsum, C. (Royal Radar Establishment, Malvern (UK)). Amsterdam, Netherlands; North-Holland (1981).

A discussion is presented of the requirements on semiconductor materials for use as radiation detectors. Several types of semiconductor detectors are described.

28432 **Multi-crystal spectrometer for gamma-ray coincidence measurements.** Barton, J.C. (Polytechnic of North London (UK)). pp 3-13 of Methods of low-level counting and spectrometry. Proceedings Series. Vienna, Austria; IAEA (1981).

From IAEA international symposium on methods of low-level counting and spectrometry; Berlin, F.R. Germany (6 Apr 1981).

A multiple γ-ray spectrometer has been constructed using six thallium activated sodium-iodide detectors. Two of the crystals are 170 mm in diameter and 50 mm thick, the other four are 75 mm in diameter and 75 mm thick. They surround a sample volume of about 0.5 ltr. The output of each scintillator is digitized and a microprocessor used to select events of particular characteristics. The apparatus is operated in a shielded enclosure in the Holborn underground laboratory in London. The performance of the spectrometer has been investigated using positron sources of ^{22}Na and ^{26}Al. It was then used to measure the cosmogenically produced activities of these isotopes in a 335-g fragment of the Mayo Belwa meteorite. It is shown that the problems due to self-absorption factors and the variation of efficiency with position in the sample volume can be solved by recording both twofold and threefold coincident spectra. It is then practicable to determine the ratio of ^{22}Na to ^{26}Al in the meteorite to an accuracy of about 3% and their absolute activities to about 6%. It is suggested that this type of apparatus could be useful for measuring other multiple γ-emitting isotopes in extended specimens.

28433 **Design and environmental applications of an ultra-low background, high-efficiency intrinsic Ge gamma-ray spectrometer.** Wogman, N.A. (Battelle Pacific Northwest Labs., Richland, WA (USA)). pp 15-29 of Methods of low-level counting and spectrometry. Proceedings Series. Vienna, Austria; IAEA (1981).

From IAEA international symposium on methods of low-level counting and spectrometry; Berlin, F.R. Germany (6 Apr 1981).

A coincidence shielded intrinsic Ge gamma-ray spectrometer incorporating a 25% efficient, high-resolution coaxial diode inside a 30-cm-diameter NaI(Tl) shield is described. System design eliminates the major cause of background and minimizes cosmic-ray created background events through the use of electronic means. The system provides a peak-to-Compton ratio of greater than 1000 to 1 for ^{137}Cs and high sensitivity for both low and high level radionuclide measurements. At 3 MeV the background is 0.000058 counts/min per keV. At 1 MeV it is 0.00048 counts/min per keV, and at 0.5 MeV it is 0.0045 counts/min per keV. Traces of primordial radionuclides create background events such as at 2.614 MeV (0.016 counts/min total peak area), at 2.448 MeV (0.0058 counts/min per total peak area), and at 2.204 MeV (0.023 counts/min per total peak area). The system is discussed with respect to its background design, methods to improve its design, and its application to measurements of neutron-activated and environmental materials problems.

28434 **Methods of calibrating a gamma spectrometer for qualitative and quantitative analysis of low-level radioactivity in geological and environmental samples.** El-Assaly, F.M. (Atomic Energy Establishment, Cairo (Egypt)). pp 41-57 of Methods of low-level counting and spectrometry. Proceedings Series. Vienna, Austria; IAEA (1981).

From IAEA international symposium on methods of low-level counting and spectrometry; Berlin, F.R. Germany (6 Apr 1981).

Absolute calibration of gamma spectrometers depends on different physical parameters that affect quantitatively and qualitatively the assessment of low-level artificial and natural radioactivity in environmental and geological samples. The total number of counts in the full energy peak of the gamma line is proportional to the area below the peak which should be estimated free from systematic errors and with sufficient precision. The resolution (FWHN) and maximum ordinate (Y_0) will be subject to systematic errors. Graphi-

cal methods are proposed for estimating the resolution and the true values of the maximum ordinate (Y_0). One Ge(Li) and three NaI(Tl) detectors are optimized in order to be used for the absolute measurements of environmental and geological samples. The natural level of radium-226 activity was determined at two sites and different techniques were used to estimate K, Th, and U in the geological samples.

28435 GSF anticoincidence-shielded Ge(Li) gamma-ray spectrometer and its application to the analysis of environmental samples. Hoetzl, H.; Winkler, R. (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H. Muenchen, Neuherberg (Germany, F.R.). Inst. fuer Strahlenschutz). pp 77-91 of Methods of low-level counting and spectometry. Proceedings Series. Vienna, Austria; IAEA (1981).

From IAEA international symposium on methods of low-level counting and spectrometry; Berlin, F.R. Germany (6 Apr 1981).

A high-efficiency gamma-ray spectrometer has been designed and built to provide simultaneous anticoincidence and coincidence spectrometry of low-level environmental samples. The spectrometer consists of a large-volume Ge(Li) detector as the main detector and a well-type NaI(Tl) guard detector. The Ge(Li) detector is a closed-end coaxial detector housed in a crystal of the vertical dip-stick type. Its relative photopeak efficiency is 27.5%. The guard counter is a 23-cm-dia by 23-cm-long NaI(Tl) crystal with a 7.8-cm-dia by 18-cm-deep center well. The passive shield consists of a 10-cm lead shield with copper and cadmium lining. The electronics is designed to operate independently and simultaneously in the anticoincidence mode as well as in the coincidence or in the normal passive shield mode. When operating in the anticoincidence mode the Compton edge of ^{137}Cs is reduced by a factor of 7.7 to provide a peak-to-Compton edge ratio of 480:1. Bulk samples up to about 300 cm^3 can be measured on the top of the detector end cap inside the well of the NaI(Tl) crystal. The lower limit of detection (1000 min counting time, 95% confidence level) for ^{137}Cs is 1.6 pCi in a 3.8-cm-dia by 3.5-cm-high sample geometry. The design of the spectrometer, its properties and the application to investigations on the migration of radionuclides in the soil, the analysis of radioactive emissions of coal-fired power plants and to fallout studies are described.

28436 Low-level laboratory for alpha and gamma counting of environmental samples. Schell, W.R.; Vick, C.E.; Wurtz, E.A. (Washington Univ., Seattle (USA). Lab. of Radiation Ecology). pp 125-149 of Methods of low-level counting and spectrometry. Proceedings Series. Vienna, Austria; IAEA (1981).

From IAEA international symposium on methods of low-level counting and spectrometry; Berlin, F.R. Germany (6 Apr 1981).

The development of a low-level counting laboratory for the measurement of alpha- and gamma-ray emitting radionuclides in environmental samples is presented. A microcomputer-based counting system has been set up which consists of 12 Si-surface barrier detectors and four Ge(Li) detectors and associated analog-to-digital converters interfaced to a Nuclear Data Corporation ND6620 data acquisition and processing system. Sample preparation includes Ge(Li) detector calibration of a few container sizes and several counting matrix densities. A procedure for ^{241}Pu analysis has been adapted for a low-level liquid scintillation counter and used to measure samples collected at several atolls in the Marshall Islands. The ^{241}Pu/sup 239,240/Pu ratio is generally approximately 20 when decay-corrected back to 1956. However, ratios of from 10 to 26 were measured, indicating that the ^{241}Pu/sup 239,240/Pu ratios may be used to detect particular sources of plutonium isotopes, i.e., from different nuclear detonations or from nuclear waste disposal. Measurements of plutonium and ^{210}Pb have been made of a nuclear waste disposal site 4000 m deep located off the coast of New York, USA. Because of the low-level activity of the plutonium present, measurement times often exceeded 10,000 min. The long-term reliability of the system is proved by these measurements and by the results of the interlaboratory calibration.

28437 Stability of two silicon detectors in low-level alpha counting. El-Daoushy, M.F.A.F. (Uppsala Univ. (Sweden). Fysiska Institutionen). pp 151-160 of Methods of low-level counting and spectrometry. Proceedings Series. Vienna, Austria; IAEA (1981).

From IAEA international symposium on methods of low-level counting and spectrometry; Berlin, F.R. Germany (6 Apr 1981).

Two silicon surface barrier detectors were studied under laboratory conditions. One of them, detector No. 1, was contaminated by ^{210}Po and ^{208}Po. Its background characteristics were examined during a long period when the detector was sometimes left without bias. The variations in leakage current due to temperature fluctuations, as in the case of detector No. 2, degraded the resolution and caused some counting instabilities. Labelling or internal yield tracers in chemical extractions could promote the study of the detector stabilities and, to a certain extent, remedy any instabilities.

28438 Standardized low-level measurement methods for environmental studies. Mishra, U.C.; Lalit, B.Y.; Shukla, V.K.; Ramachandran, T.V. (Bhabha Atomic Research Centre, Bombay (India). Air Monitoring Section). pp 189-199 of Methods of low-level counting and spectrometry. Proceedings Series. Vienna, Austria; IAEA (1981).

From IAEA international symposium on methods of low-level counting and spectrometry; Berlin, F.R. Germany (6 Apr 1981).

Since 1958 this centre (BARC) has been carrying out an extensive programme of country-wide monitoring of radioactive fallout and natural radioactivity. This required the development and setting up of a large number of low-level alpha, beta and gamma counting systems and standardization of sampling, measurement and analysis procedures for a variety of sample matrices. Interference in gamma spectrometry due to ^{41}A produced by nuclear research reactors at this centre required the setting up of a low-level counting laboratory away from the centre. This laboratory was constructed in 1973 at the BARC Hospital complex, about 6 km from the reactors and was fully equipped and commissioned in 1976. The entire nuclear instrumentation has been done in this Air Monitoring Section. Experience gained in the early years of the development of low-level counting systems and their standardization procedures have been discussed in earlier publications. Low-level systems are required primarily for (a) beta counting and (b) gamma spectrometry. Optimization of the overall capabilities in this regard requires: (1) Increasing the counting efficiency by correct choice of detector systems; (2) Decreasing the background by graded massive shielding and electronic systems, e.g. anticoincidence shielding; and (3) Increasing selectivity and sensitivity either by employing selective chemical separation methods, or by the high-resolution systems, sample preconcentration, in the use of optimum sample geometry for the best counting efficiency. Developments in all the above areas carried out at this laboratory are briefly reviewed. The approach followed here is best suited for a developing country with limited financial resources. The lowest detection limits for various sample matrices for the systems currently in use are also given.

28439 Detection of environmental radioactive contamination levels using a liquid-scintillation counter. Calisto, W.; Kun, A.; Campos, E. (Centro de Investigaciones Nucleares, Montevideo (Uruguay)). pp 201-209 of Methods of low-level counting and spectrometry. Proceedings Series. Vienna, Austria; IAEA (1981). (In Spanish)

From IAEA international symposium on methods of low-level counting and spectrometry; Berlin, F.R. Germany (6 Apr 1981).

A high-efficiency LS-100 C liquid scintillation counter was used to detect low levels of environmental activity. Different concentrations of primary scintillator were tested and these established the most suitable values. Work was carried out at the same time to find conditions which would ensure a low background and high efficiency. To reduce the sample volume used, various types of chelating agents were utilized: 8-hydroxyquinoline (oxine), tannic acid, cupferron, dimethylglioxime, and beta-naphthol. These were tested at pH levels of 1, 6, and 11. Measurements were performed by means of the Cherenkov effect using substances with differing refraction indices - 26% sodium chloride, water, glycerine, carbon bi-

sulphide, nitrobenzene, benzyl alcohol and toluene. Finally, work was done on comparing spectra obtained by Cherenkov radiation and by ^{90}Sr and ^{90}Y beta radiation, respectively. Clearly differentiated zones were obtained, thus making it possible to distinguish one isotope from another in an equilibrium solution.

28440 **Low-level counting systems in deep underground laboratories.** Oeschger, H.; Beer, J.; Loosli, H.H.; Schotterer, U. (Bern Univ. (Switzerland). Physikalisches Inst.). pp 459-474 of Methods of low-level counting and spectrometry. Proceedings Series. Vienna, Austria; IAEA (1981).

From IAEA international symposium on methods of low-level counting and spectrometry; Berlin, F.R. Germany (6 Apr 1981).

Measurements with the same equipment in laboratories with different muon fluxes and wall materials help to disentangle the relative contribution of the different background components. Gas proportional counters, a Ge(Li) detector and a liquid-scintillation counter were tested in a normal laboratory, two underground laboratories (70 m water equivalent), one of which was shielded with special concrete, and a laboratory in the Gotthard-Strassentunnel (3000 m water equivalent underground). When using low radioactive materials for detectors and shielding in a normal laboratory μ-induced events were the main background contribution. The best background values for all systems were obtained in the shielded underground laboratory (γ- and μ-fluxes each reduced by a factor of 10). There, two-thirds of the background events are attributed to the radioactivity of detectors and shields. In the Gotthard laboratory the γ-flux is higher by a factor of three than in a normal laboratory requiring a special heavy shielding. Examples of backgrounds in the shielded underground laboratory are for: (i) ^{14}C-dating - 1000 cm^3 copper counter with 4.9 bar CH_4: 0.51 counts/min background compared with 33.05 counts/min modern net effect; (ii) ^{39}Ar-dating - 100 cm^3 copper counter with 19 bar Ar ($+CH_4$): 0.10 counts/min background compared with 0.18 counts/min modern net effect; (iii) ^3H-measurements - internal anticoincidence counter with 1300 cm^3 (active volume); 1.3 bar CH_4: 0.06 counts/min background compared to 75 TU/(counts/min); commercial liquid-scintillation counter with 10 cm^3 water plus 12 cm^3 scintillator: 0.60 counts/min background compared with 60 TU/(counts/min).

28441 **New design for a low-level proportional counter for tritium.** Carmi, I. (Weizmann Inst. of Science, Rehovoth (Israel). Dept. of Isotopes); Breskin, A.; Chechik, R.; Cohen, M.; Zwang, N. (Weizmann Inst. of Science, Rehovoth (Israel). Dept. of Physics). pp 477-485 of Methods of low-level counting and spectrometry. Proceedings Series. Vienna, Austria; IAEA (1981).

From IAEA international symposium on methods of low-level counting and spectrometry; Berlin, F.R. Germany (6 Apr 1981).

A new design for a low-level tritium proportional counter is described. The design is based on the multiwire proportional counter (MPC) and drift-chamber (MWDC) concept used in high-energy physics. The MPC plane is subdivided into several detection strips, and logic (L) analysis of the projection length of an ionizing track on this plane replaces the anticoincidence counter. The performance of the counter in the rejection of background events was evaluated by simulation for several configurations. It is shown that the preferred configuration is cylindrical. For a fine enough subdivision the analysis by L only can perform better than the combination of energy (E) and rise-time (R) analyses. A residual background due to events very close to the walls of the counter can also be eliminated by logic. Thus, it is possible to count tritium in the new counter by logic only. The results of the simulation are confirmed by experimental data from the literature and from a prototype counter.

28442 (LYCEN—8102, pp S10.1-S10.8) **Diogene, a 4π detector for the heavy ion physics with Saturne.** Alard, J.P.; Augerat, J. (Clermont-Ferrand-2 Univ., 63 - Aubiere (France). Lab. de Physique Corpusculaire); Babinet, R. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Physique Nucleaire). [nd]. (In French). Dep. NTIS (US Sales Only).

From 6. biannual session of nuclear physics; Aussois, France (2 Feb 1981).

A 4π-detection set up is presently being built around the Saturne II facility, to study central collisions between high energy heavy ions. This set up is essentially composed of a cylindrical drift chamber, triggered by a 30-scintillators multiplicity filter. A schematic description of the detector is given first. Then the present status of the project is presented, at last some progresses on track reconstruction technique with simulated events are given.

4402 Radiation Effects On Instrument Components, Instruments, Or Electronic Systems

28443 **(UCRL—85809) Susceptibility determination under uncertainty.** Martin, L.C.; Bogdan, E.J.; Cabayan, H.S. (Lawrence Livermore National Lab., CA (USA)). 1980. Contract W-7405-ENG-48. 9p. (CONF-8009220—1). NTIS, PC A02/MF A01. Order Number DE82001667.

From International conference on electromagnetic compatibility; Southampton, UK (16 Sep 1980).

The determination of the susceptibility of systems, equipment, or components to external electromagnetic stimuli is confounded by uncertainties. A probabilistic approach to such determination is outlined and discussed. This approach recognizes variation in the uncertainties, makes use of the probability distribution in describing this variation, and relies heavily on computer-oriented models for the interaction phenomena. In practical application, fairly extensive computer program tools are necessary for the Monte-Carlo systems and circuit analyses required.

4403 Miscellaneous Instruments

REFER ALSO TO CITATION(S) 28177, 28712

28444 (CERN—81-07, pp 450-453) **Bit slice micro-processor GESPRO as a project in the UA2 experiment.** Becam, C.; Bernaudin, P.; Delanghe, J.; Mencik, M.; Merkel, B.; Plothow, H. (Ecole Normale Superieure, 91 - Orsay (France). Lab. de l'Accelerateur Lineaire); Fest, H.M.; Lecoq, J.; Martin, H.; Meyer, J.M. (Mulhouse Univ., 68 (France). Lab. d'Electronique et d'Instrumentation Nucleaire). 17 Jul 1981. Dep. NTIS (US Sales Only).

From Conference on the application of microprocessors to high energy physics experiments; Geneva, Switzerland (4 May 1981).

The bit slice micro-processor GESPRO, as it is proposed for use in the UA 2 data acquisition chain and trigger system, is a CAMAC module plugged into a standard Elliott System crate via which it communicates as a slave with its host computer (ND, DEC). It has full control of CAMAC as a master unit. GESPRO is a 24 bit machine (150 ns effective cycle time) with multi-mode memory addressing capacity of 64 K words. The micro-processor structure uses 5 busses including pipe-line registers to mask access time and 16 interrupt levels. The micro-program memory capacity is 2 K (RAM) words of 48 bits each. A special hardwired module allows floating point (as well as integer) multiplication of 24 x 24 bits, result in 48 bits, in about 200 ns. This micro-processor could be used in the UA2 data acquisition chain and trigger system for the following tasks: (a) online data reduction, i.e. to read DURANDAL (fast ADC's = the hardware trigger in the experiment), process the information (effective mass calculation, etc.) resulting in accepting or rejecting the event. (b) read out and analysis of the accepted data (collect statistical information). (c) preprocess the data (calculation of pointers, address decoding, etc.). The UA2 version of GESPRO is under construction, programs and micro-programs are under development. Hardware and software will be tested with simulated data. First results are expected in about one year from now.

28445 (INIS-mf—6819, pp 636) **Effect of geometric parameters of the "source-sample-detector" system on the peak noise ratio while x-ray fluorescent study of alloys by means of the ^{241}Am source.** Sinitsyn, V.N.; Savchenko, M.A.; Bityutskaya, L.V.; Volkov, V.F. 1981. (In Russian). Dep. NTIS (US Sales Only).

From 31. conference on nuclear spectroscopy and nuclear structure; Samarkand, USSR (14 Apr 1981).

28446 (INIS-mf—6819, pp 640) **Automatization of nonuniform magnetic field measuring by the nutation method.** Efremov, D.A.; Zhernovoi, A.I.; Moskvin, N.G.; Petrov, V.N.; Popov, S.V. 1981. (In Russian). Dep. NTIS (US Sales Only).

From 31. conference on nuclear spectroscopy and nuclear structure; Samarkand, USSR (14 Apr 1981).

28447 (INIS-mf—6819, pp 641) **Nutation transducer for uniform and nonuniform magnetic fields.** Zhernovoi, A.I.; Moskvin, N.G.; Popov, S.V. 1981. (In Russian). Dep. NTIS (US Sales Only).

From 31. conference on nuclear spectroscopy and nuclear structure; Samarkand, USSR (14 Apr 1981).

28448 (INIS-SU—59, pp 110-113) **Direct current amplifier for small temperature change detecting.** Kochnov, A.I.; Koshamanov, E.A.; Odintsov, A.A. 1980. (In Russian). Dep. NTIS (US Sales Only).

In Thermophysical problems in nuclear reactors. Issue 9. Experimental and calculation technique.

The flowsheet of the device, intended for detecting the small temperature perturbations, is considered. SF4 photoresistor is used in this device as temperature detector. The main parameters of current and voltage amplifiers, being a part of the described device, are given. It is noted, that the small dimensions of the device permit to locate it close to photodetector, and by decreasing the length of connecting wires to reduce essentially the noise and power induction from the alternating current supply line.

28449 (LA-UR—81-2950) **Small rocket tornado probe.** Colgate, S.A. (Los Alamos National Lab., NM (USA)). 1982. Contract W-7405-ENG-36. 11p. (CONF-820105—1). NTIS, PC A02/MF A01. Order Number DE82002402.

From 12. conference on severe local storms; San Antonio, TX, USA (11 Jan 1982).

Portions of document are illegible.

A (less than 1 lb.) paper rock tornado probe was developed and deployed in an attempt to measure the pressure, temperature, ionization, and electric field variations along a trajectory penetrating a tornado funnel. The requirements of weight and materials were set by federal regulations and a one-meter resolution at a penetration velocity of close to Mach 1 was desired. These requirements were achieved by telemetering a strain gage transducer for pressure, micro size thermister and electric field, and ionization sensors via a pulse time telemetry to a receiver on board an aircraft that digitizes a signal and presents it to a Z80 microcomputer for recording on mini-floppy disk. Recording rate was 2 ms for 8 channels of information that also includes telemetry rf field strength, magnetic field for orientation on the rocket, zero reference voltage for the sensor op amps as well as the previously mentioned items also. The absolute pressure was recorded. Tactically, over 120 h were flown in a Cessna 210 in April and May 1981, and one tornado was encountered. Four rockets were fired at this tornado, missed, and there were many equipment problems. The equipment needs to be hardened and engineered to a significant degree, but it is believed that the feasibility of the probe, tactics, and launch platform for future tornado work has been proven. The logistics of thunderstorm chasing from a remote base in New Mexico is a major difficulty and reliability of the equipment another. Over 50 dummy rockets have been fired to prove trajectories, stability, and photographic capability. Over 25 electronically equipped rockets have been fired to prove sensors transmission, breakaway connections, etc. The pressure recovery factor was calibrated in the Air Force Academy blow-down tunnel. There is a need for more refined engineering and more logistic support.

28450 (PB—81-804056) **Magnetometers. 1964-1980 (citations from the NTIS data base). Report for 1964-1980.** (National Technical Information Service, Springfield, VA (USA)). Feb 1981. 247p. NTIS PC N01/MF N01.

The cited reports discuss the theory, design, performance, and calibration of various types of magnetometers. Only equipment studies are included; reports describing only applications or processing of data are generally excluded. (This updated bibliography contains 240 citations, 16 of which are new entries to the previous edition.)

28451 (PB—81-804064) **Magnetometers. 1970-1980 (citations from the Engineering Index Data Base). Report for 1970-1980.** (National Technical Information Service, Springfield, VA (USA)). Feb 1981. 244p. NTIS PC N01/MF N01.

The cited reports from a worldwide literature survey discuss the theory, design, performance, and calibration of various types of magnetometers. Only equipment studies are included; reports describing only applications or processing of data are generally excluded. (This updated bibliography contains 237 citations, 24 of which are new entries to the previous edition.)

28452 (PB—81-971028) **Miniature personal uv solar dosimeter: small light-powered meter measures accumulated radiation in the ultraviolet or other selected regions. NTIS tech note.** (National Aeronautics and Space Administration, Washington, DC (USA)). Nov 1981. 1p. For information about subscribing to Tech Notes, please write NTIS Subscription Dept.

This citation summarizes a one-page announcement of technology available for utilization. A miniature integrating light meter originally developed for use in space has many other possible applications. Small enough to be worn unobtrusively, it can measure accurately the radiation dose accumulated for a few minutes or over a period of weeks. It can measure total light or selected wave bands, such as UV or IR. The primary practical advantages of the dosimeter are its potentially low cost, small size, accuracy, and adaptability to specific wave-band measurements. Medical applications suggested include as a research tool for studies of skin cancer, vitamin D production, and jaundice and for possible use in conjuction with the treatments involving Sunlight exposure. It could be further used to measure integrated Sunlight for solar-energy design, for agriculture and meteorology, and to study and monitor the stability of materials and environmental and occupatinal lighting. The meter uses a planar-diffused silicon photovoltaic detector as a sensor and a commercially available electrochemical coulometer to measure light accumulation....FOR ADDITIONAL INFORMATION: Contact: Inquiries concerning nonexclusive or exclusive license for its commercial development should be addressed to the Patent Counsel, Langley Research Center, Hampton, VA. Refer To LAR-12469.

28453 (PNL—4100-Pt.1, pp 123-124) **Development of blood irradiators.** Hungate, F.P. Feb 1982. NTIS, PC A10/MF A01.

In Pacific Northwest Laboratory annual report for 1981 to the DOE Office of Energy Research. Part 1. Biomedical sciences.

Over a period of several years, a small, fully portable blood irradiator has been developed for ultimate use in suppressing early rejection of organ transplants in humans. It could also be useful for other medical problems, e.g., treating some forms of leukemia or arthritis. The units have been successfully evaluated in several animal species, resulting in sharply reduced lymphocyte levels and prolonged skin-graft retention. Work during the past year was directed toward development of hardware in anticipation of kidney transplant studies, to be performed in dogs in FY 1982, and identifying whether dose fractionation significantly changed lymphocyte response.

45 EXPLOSIONS AND EXPLOSIVES

4501 Chemical

28454 Method for the determination of high explosives employing chemiluminescence - 1. Neary, M.P. (Los Alamos Sci Lab, NM). *Nuclear Materials Management;* 9: 370-380(1980). (CONF-800655—).

From 21. annual meeting of the Institute of Nuclear Materials Management; Palm Beach, FL, USA (30 Jun 1980).

A study of predetonation detection of high explosives (HE) vapor by chemical means has been initiated and the first part completed. The research has been centered on chemically coupling the photolysis products of HE to the luminol chemiluminescence reaction and the use of a micellized solvent as a gas sampling medium.

4502 Nuclear

REFER ALSO TO CITATION(S) 28546

50 ENVIRONMENTAL SCIENCES, ATMOSPHERIC

5001 Basic Studies

REFER ALSO TO CITATION(S) 28498, 28522

28455 (AERONOMICA-ACTA-A—213-1980) Stratospheric chemical and thermal response to long term variability in solar uv irradiance. Brasseur, G.; Simon, P.C. (Institut d'Aeronomie Spatiale de Belgique, Brussels). 1980. 86p. Institut d'Aeronomie Spatiale de Belgique, Brussels.

The chemical response of the stratosphere to possible long term variability in solar ultraviolet irradiance is analyzed taking into account the thermal feedback effect on the reaction rates. Numerical values of ultraviolet and visible irradiation fluxes are given for aeronomic modeling purposes and a possible variability related to the 11 year solar cycle is suggested. This variability is introduced on a stratospheric two dimensional model which simulates the zonally averaged distribution of the chemical species related to the oxygen, hydrogen, nitrogen and chlorine families. The results lead to a total ozone variation on the order of 3% from minimum to maximum solar activity, with a maximum of about 10% in the upper stratosphere. At these heights, the calculated temperature change is close to 2 to 4 deg. The N2O concentration appears to be one of the most sensitive to long term solar variability and monitoring of this constituent is proposed to provide information on solar variability in the ultraviolet. (ESA)

28456 (FWS/OBS—80/26, pp 84-93) **The baseline study as a tool in environmental impact assessment.** Hirsch, A. Jun 1980. NTIS, PC A11/MF A01.

From Symposium on biological evaluation of environmental impact; New Orleans, LA, USA (2 Jun 1976).

The adequacy of baseline studies as a tool in environmental impact assessment is discussed. The limitations of such studies are defined and suggestions are made for improved methodologies.

28457 (PB—82-109323) Fish resources and aquatic habitat impact assessment methodology for the Ohio River Basin Energy Study area. Leuthart, C.; Spencer, H.T. (Ohio River Basin Energy Study, Urbana, IL (USA)). Sep 1981. 461p. NTIS, PC A20/MF A01.

This report was prepared as part of the Ohio River Basin Energy Study (ORBES), a multidisciplinary policy research program supported by the Environmental Protection Agency. Its purpose is to provide information on the fish resources, water quality, and aquatic ecology of the Ohio River Basin. This information is used as background for the assessment of water-related impacts under a number of energy development scenarios.

28458 Seasonal climatic anomaly types for the North Pacific sector and western North America. Blasing, T.J. (Oak Ridge National Lab., TN); Lofgren, G.R. *Monthly Weather Review;* 108: No. 6, 700-719(Jun 1980). Contract W-7405-ENG-26.

Recurrent patterns of seasonal sea level pressure anomaly over the North Pacific sector and western North America are objectively identified using correlation coefficients between anomaly maps as a pattern recognition device. Five major anomaly type patterns are identified for each season. Each pressure anomaly type pattern is briefly discussed in terms of atmospheric circulation features and associated anomaly patterns of temperature and precipitation over the contiguous United States. Occurrences of each type pattern are analyzed in the time domain. Spring and summer types featuring below-normal pressures at high latitudes, associated with warm, dry conditions in the United States, occurred relatively often during the period of warm Northern Hemisphere temperatures from the mid-1920's to the mid-1950's. Types featuring above-normal pressure over high-latitude land areas tended to occur frequently for all seasons during the period of relatively cool Northern Hemisphere temperatures prior to 1920. This study is useful for investigating variations in the nature or frequency of certain types of large-scale atmospheric circulation features in relation to global-scale temperature trends.

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REFER ALSO TO CITATION(S) 27644, 27648, 27656, 27657, 27800, 27801, 27802, 27816, 27817, 28139, 28176, 28232, 28241, 28242, 28518, 28519, 28520, 28521, 28550, 28701, 28702, 28703, 28712, 28722, 28975

28459 (BMFT-FB-T—79-90) Process for removing sulfur oxides from gases with direct production of a usable finished reaction product. Final report. Mohn, U. (Walther Cie A.G., Cologne (Germany, F.R.)). Dec 1979. 25p. (In several languages). NTIS, PC A02/MF A01.

The feasibility of a scrubbing process for the removal of sulfur oxides from factory flue gases is shown. Laboratory experiments to define the reaction chemistry of adding gaseous ammonia compounds to flue gases were cpnducted. Results led to the construction of a pilot plant for processing 20,000 cu m/hr of flue gas. The sulfur oxides are absorbed in the scrubbing process. Concentration of the scrubbing liquid is increased to a salinity level close to the saturation point. The scrubbing liquid is fed into an oxidation facility and finally spray dried in a hot flue-gas flow. The resulting product is separated as dry ammonia sulfate powder in an electrostatic precipitator. The end product can be directly used and is availabe dry without application of external heat. No external heat is required for reheating of the cleaned gases. No waste water is produced during the process. (ESA)

28460 (BNL—30101) Compilation of source emissions data and their use in air quality models. Benkovitz, C.M. (Brookhaven National Lab., Upton, NY (USA)). 1982. Contract AC02-76CH00016. 4p. (CONF-820101—5). NTIS, PC A02/MF A01. Order Number DE82002225.

From 3. joint conference on applications of air pollution meteorology; San Antonio, TX, USA (11 Jan 1982).

The Multistate Atmospheric Power Production Pollution Study (MAP3S) is addressed to the physical understanding and the mathematical characterization of wet and dry deposition of atmospheric pollutants. The compilation of a source emissions inventory is one of the tasks of the Central Data Coordination project of the MAP3S program. One of the major problems encountered in correlating these data sets is in the area of standardizarion. The use and refinement of emission factor data is an ongoing project. An overall summary of the current inventory data on NO/sub x/, SO/sub x/, CO, hydrocarbons, and particulates is presented. A breakdown of the point source emissions by industrial groupings is tabulated. To allow greater refinement in the treatment of area source data a proposed methodology to disaggregate these emissions to a subcounty level involves the use of the population figures and population centroids available in the MED-X file. Depending on the size of the area to be modeled, an appropriate level of demographic data aggregation can be chosen and population figures and population centroids calculated using the figures for enumeration districts and block groups available in MED-X. The emissions data can then be apportioned to each centroid according to population and again considered as low-level pseudo-point sources. Implementation of this methodology is currently being studied.

28461 (CONF-801156—2) Inhalation exposure system for toxicological studies of diesel oil aerosols. Holmberg, R.W.; Moneyhun, J.H. (Oak Ridge National Lab., TN (USA)). 1980. Contract W-7405-ENG-26. 25p. NTIS, PC A02/MF A01. Order Number DE82004079.

From Symposium on diesel fuel obscurants; Ft Detrick, MD, USA (13 Nov 1980).

This report summarizes the physical and chemical investigations carried out during the past year as part of a study of the inhalation toxicology of diesel fuel aerosols. Diesel fuel is pumped on to the hot manifold of a diesel powered tank where it flash evaporates, and is carried through the exhaust system, then finally expelled into the cooler air where it condenses to form a dense aerosol. This aerosol consists primarily of micron sized droplets of diesel oil; the black sooty particles of normal diesel exhausts are only a very minor fraction of it. The first part of this presentation details the development of a generator which adequately simulates this generation process in a laboratory environment; its implementation onto existing Rochester-type exposure chambers including modifications of these chambers to reliably handle such a dense aerosol; a monitoring system to document exposures; and the physical characterization of the aerosol produced. The second half of the presentation discusses the chemical characterization of the aerosol with particular regard to comparing the laboratory-simulated aerosol with an actual one.

28462 (LA-UR—81-2484) Regional air quality in the four corners studys region: modeling approach. Nochumson, D. (Los Alamos National Lab., NM (USA)). 1982. Contract 7405-ENG-36. 6p. (CONF-820101—3). NTIS, PC A02/MF A01. Order Number DE81030251.

From 3. joint conference on applications of air pollution meteorology; San Antonio, TX, USA (11 Jan 1982).

A two-dimensional Eulerian air pollutant transport model was used in an air quality study of the Four Corners region conducted for the National Commission on Air Quality. The regional modeling methodology and some sample results from the regional air quality analysis are presented. One major advantage of the regional transport model that was employed is that its solution involves the calculation of transfer coefficients that relate emissions to ambient concentrations and deposition and which can be used repeatedly to evaluate alternative scenarios and regulatory policies which represent different emission source configurations. The regional transport model was used in the calculation of the concentration and deposition of SO_2, SO_4, and primary fine particulates; and these estimates were used as inputs to regional atmospheric visibility and mass budget calculations. Previous studies have shown that the methods used in the regional air quality analysis give good agreement when comparing observed and estimated values.

28463 (NASA-CR—3450) Data quality: 1979 southeastern Virginia urban plume study (SEV-UPS): surface and airborne studies. Final report. White, J.H.; Strong, R.B.; Saeger, M.L.; Eaton, W.C.; Lommerdahl, J.B. (Research Triangle Inst., Research Triangle Park, NC (USA)). Jul 1981. 66p. NTIS, PC A04/MF A01.

The SEV-UPS field study conducted during August 1979 involved the coordinated air quality data collection efforts of three different organizations operating a total of four aircraft and 12 ground stations. Incorporated into plans for that program were numerous quality assurance activities designed to identify potential hazards for data quality in time for their correction and to take data to allow assessment of the consistency of the data from different stations. The purpose of this study was to document QA procedures that were performed by participating agencies and revise data from all platforms for mutual compatibility. For the latter effort, cases were identified on 21 occasions on seven different days where two or more monitoring systems were operating in the same location at nearly the same time. Data from the systems involved were tabulated in 200 m altitude segments, averaged and compared to detect any bias between measurements made from different systems. The results of these comparisons along with the results of independent performance audits are presented.

28464 (NASA-TM—83142) Summary of measurement results of ozone, methane, and nonmethane hydrocarbons for C-54 aircraft. 1979 southeastern Virginia urban plume study. Cofer, W.R. III; Purgold, G.C.; Gregory, G.L. (National Aeronautics and Space Administration, Hampton, VA (USA). Langley Research Center). Aug 1981. 60p. NTIS, PC A04/MF A01.

Methane, nonmethane hydrocarbon, and ozone data collected in a C-54 aircraft during the 1979 Southeastern Virginia Urban Plume Study are presented. Three major aircraft experiments were flown on five separate days in August collecting 20 hours of flight data. Direct correlation between ozone and hydrocarbon plumes was observed on several occasions.

28465 (PB—81-150377) Atmospheric pollution from vehicle emissions: measurements in situations of restricted dispersion. Hickman, A.J.; Lunn, C.A. (Transport and Road Research Lab., Crowthorne (UK)). 1980. 32p. NTIS, PC A03/MF A01.

Measurements of carbon monoxide and lead levels were made under two bridges, built to carry motorways over roads trafficked by 16000 and 6000 vehicles/day, in order to investigate whether pollutant levels were higher than those normally found at open sites. The monitoring equipment was located in the center of both bridges and also near a gap in one bridge. The average carbon monoxide levels found were 3.8, 3.7, and 5.3 ppM and the average lead levels were 2.4, 2.7, and 3.9 micrograms/cu m. A detailed analysis was made of the carbon monoxide data. It was not possible with the lead data because of the much longer sampling period. It was found that the conditions at the more heavily trafficked site were comparable with those at an open site. At the less heavily trafficked site pollution levels were higher than expected probably due to the proximity of a roundabout, causing vehicles' engines to operate in more polluting modes, and also to the reduced turbulence from lower traffic flows.

28466 (PB—81-150880) Study of the adequacy of air monitoring. Part II. Inhalable particulates. Draft report. Patterson, R.M.; Cavanagh, L.A.; Ruff, R.E. (SRI International, Menlo Park, CA (USA)). Dec 1980. 121p. NTIS, PC A06/MF A01.

This is a study of the current status of inhalable particulate monitoring, the need for future monitoring, and of the status of a National Ambient Air Quality Standard for inhalable particulates. The study asked about the extent of the data base available on particulates, the quality of current monitoring techniques, a size-specific standard for particulates, and possible effects of a standard.

28467 (PB—81-153231) Ambient monitoring guidelines for prevention of significant deterioration (PSD). (Environmental Protection Agency, Research Triangle Park, NC (USA). Office of Air Quality Planning and Standards). Nov 1980. 82p. NTIS, PC A05/MF A01.

Ambient air monitoring guidelines are described for sources that may be required to monitor the air quality under the Prevention of Significant Deterioration (PSD) regulations. Some step-by-step discussion is presented for a source to determine if monitoring will be necessary. Situations where existing air quality and meteorological data, modeling, and use of assumed background concentrations for certain areas may be used in lieu of monitoring, are shown. If a source must undertake a monitoring program, general guidance is given for pollutants to be monitored, number and location of monitoring sites, equipment, frequency and duration of sampling, and data reporting. More detailed guidance is discussed for air quality monitoring probe citing criteria for various pollutants, meteorological monitoring, and quality assurance procedures.

28468 (PB—81-153496) Analysis of the emission inspection analyzer. Clemmens, W.B. (Environmental Protection Agency, Ann Arbor, MI (USA). Inspection and Maintenance Staff). Sep 1980. 66p. NTIS, PC A04/MF A01.

Recently, there has been more emphasis on checking the performance of in-use vehicles. This is occurring through the implementation of state inspection and maintenance (I/M) programs as well as the forthcoming emission repair warranty regulations

(207(b)) authorized by the Clean Air Act. Practically all of the I/M data will be generated by field emission inspection analyzers (as opposed to laboratory equipment) in both centralized programs (i.e. central inspection lanes) and decentralized programs (i.e. inspection conducted by independent service centers). This data will affect the consumer through required maintenance, the automobile manufacturer through warranty claims, the State through emission credits, and the EPA through its ability to judge the effectiveness of the individual I/M programs. Obviously, a fundamental issue that an I/M program must deal with is the accuracy and validity of the test data taken under these programs. An inseparable part of that issue is the quality of the equipment used to obtain the data. Various state and trade associations have developed standards to control the quality of the equipment used, but as yet there are no nationally accepted minimum standards for inspection analyzers. An examination of the data validity issue should then encompass both - Is the data generated under present conditions sufficiently valid, and - Is there a need for minimum quality standards for inspection analyzers. The subject of this report deals with these questions and issues.

28469 **(PB—81-153504) Recommended specifications for emission inspection analyzers.** Clemmens, W.B. (Environmental Protection Agency, Ann Arbor, MI (USA). Inspection and Maintenance Staff). Sep 1980. 121p. NTIS, PC A06/MF A01.

Recently, there has been more emphasis on checking the performance of in-use vehicles. This is occurring through the implementation of state inspection and maintenance (I/M) programs as well as the forthcoming emission repair warranty regulations (207(b)) authorized by the Clean Air Act. Practically all of the I/M data will be generated by field emission inspection analyzers (as opposed to laboratory equipment) in both centralized programs (i.e. central inspection lanes) and decentralized programs (i.e. inspection conducted by independent service centers). This data will affect the consumer through required maintenance, the automobile manufacturer through warranty claims, the State through emission credits, and the EPA through its ability to judge the effectiveness of the individual I/M programs. Obviously, a fundamental issue that an I/M program must deal with is the accuracy and validity of the test data taken under these programs. An inseparable part of that issue is the quality of the equipment used to obtain the data. Various state and trade associations have developed standards to control the quality of the equipment used, but as yet there are no nationally accepted minimum standards for inspection analyzers. An examination of the data validity issue should then encompass both - Is the data generated under present conditions sufficiently valid, and - Is there a need for minimum quality standards for inspection analyzers. The subject of this report deals with these questions and issues.

28470 **(PB—81-153561) Summary report of several ambient carbon monoxide studies.** Wolcott, M. (Environmental Protection Agency, Ann Arbor, MI (USA)). Nov 1980. 24p. NTIS, PC A02/MF A01.

The Federal Clean Air Act assigns to the United States Environmental Protection Agency (EPA) the responsibility to promulgate National Ambient Air Quality Standards (NAAQS) regarding carbon monoxide (CO). On August 8, 1980 EPA proposed CO standards of 25 parts per million (ppM) maximum allowable one hour expected concentration level and 9 ppM maximum allowable expected eight hour average concentration level. In an effort to achieve these standards the Clean Air Act also assigns to EPA the responsibility to promulgate regulations regarding the amount of CO new highway vehicles may emit from the tailpipe. To properly fulfill this second mandate, it is necessary to understand the conditions associated with high ambient CO concentrations. The five studies summarized in this report provide information on recent CO emission inventory estimates, the meteorological conditions associated with high ambient CO concentrations, the distribution of CO concentrations within selected cities, the effects on CO concentration levels of both meteorological conditions and traffic characteristics at typical hot spot locations and the estimated amount that in-use vehicle emissions must be reduced to achieve the NAAQS for CO.

28471 **(PB—81-153785) Exhaust emissions from twenty light duty diesel trucks.** Shelton, J.C. (Environmental Protection Agency, Ann Arbor, MI (USA)). Aug 1980. 29p. NTIS, PC A03/MF A01.

This paper describes the results of an exhaust emission testing program conducted for EPA by Automotive Testing laboratories. Twenty diesel-powered light-duty trucks were tested. Gross vehicle weight ratings for these trucks ranged from 5300 to 6200 lbs. The primary purpose of this program was to provide data to establish emission factors for light duty diesel-powered trucks. Secondary objectives included an assessment of the emission durability of the engines and an evaluation of fuel economy. The test vehicles were randomly selected from the general public in the St. Louis area using direct appeals to individual owners and referrals from other test participants. The test sequence included the Federal Test Procedure, the Highway Fuel Economy Test and several short tests. Mass emissions were also measured during individual steady state and transient modes of operation. The work was conducted during March and April of 1980. The average emission test results were very low and similar to those from diesel engines in passenger cars. It appears that diesel engines in light duty truck service demonstrate virtually no emission deterioration while in-use over their 'useful life' although two engines required major engine rebuilding before 50,000 miles.

28472 **(PB—81-154213) Iowa air quality report, 1979. Annual report.** (Iowa Dept. of Environmental Quality, Des Moines (USA). Air and Land Quality Div.). Jul 1980. 67p. NTIS, PC A04/MF A01.

Iowa's air monitoring data from 1957 to 1979 have been compiled in this report for seven pollutants monitored in the State: suspended particulates, sulfur dioxide, nitrogen dioxide, carbon monoxide, hydrocarbons, ozone, and lead. The data are presented in tabular form for each pollutant. Additional sections discussing the pollutants and pollutant sources, the air monitoring network, and the analysis of data and trends have been added.

28473 **(PB—81-155293) Electrostatic precipitator technology assessment: Visits in Japan, November 1977 - appendices. Final report, November 1977-April 1978.** Nichols, G.B. (Southern Research Inst., Birmingham, AL (USA)). Jun 1978. 700p. NTIS, PC A99/MF A01.

The report gives results of a particulate control technology assessment visit to Japan by a team of US investigators. The visit included discussions with personnel from universities, industries, and other major installations involved with particulate control. Significant research activities were noted in both the academic and industrial sectors related to particulate control and measurements. The report summarizes results of the individual discussions, observations during the tour, and discussions of technical papers. Many valuable technical papers supplied to the US team are reproduced in the Appendix of the report.

28474 **(PB—81-155327) Characterization of emissions from motor vehicles designed for low NO/sub x/ emissions. Final report, March 1977-June 1980.** Smith, L.R. (Southwest Research Inst., San Antonio, TX (USA)). Aug 1980. 545p. NTIS, PC A23/MF A01.

Tailpipe emissions were characterized for four advanced low NO/sub x/ catalyst equipped passenger cars under a variety of cyclic driving conditions. All of the vehicles had three-way catalysts, three with feedback carburetors and exhaust gas recirculation, and two with oxidation catalysts following the three-way catalysts. The emission rates of several unregulated pollutants including aldehydes, organic amines, sulfur dioxide, nitrous oxide, several individual hydrocarbons (including benzene), hydrogen sulfide, cyanide, organic sulfides, nickel carbonyl, ammonia, sulfate, trace metals, and N-nitrosodimenthylamine were determined. Additionally, the emission rates of the regulated pollutants, total hydrocarbons, carbon monoxide, and oxides of nitrogen were determined along with carbon dioxide and oxygen. Using three test fuels of varying sulfur content, the emissions were examined at an initial mileage and at 5000-mile intervals to 15,000 miles. Using a toxicity criteria, the most significant emissions were the currently regulated pollutants; sulfate was the most significant unregulated pollutant. Using

commuter exposure models, exposures less than 0.07 OSHA 8-hour Threshold Limit Values are projected for typical congested freeway situations.

28475 (PB—81-173064) United States: Canada memorandum of intent on transboundary air pollution. Atmospheric modeling, Work Group 2. Machta, L. (Environmental Protection Agency, Washington, DC (USA)). Mar 1981. 184p. NTIS, PC A09/MF A01.

The transport of air pollution from their sources to final deposition was investigated. Depositions in sensitive ecological areas are outlined. Several models were developed in both Canada and the U.S. for application in long range transport studies. The models describe sulfur deposition on an annual basis. A transfer matrix is adopted to establish a quantitative relationship between pollution emission and deposition in sensitive areas.

28476 (PB—81-174112) Survey of operating inspection/maintenance programs. Final report. Klausmeier, R.F.; Kirk, D.K. (Radian Corp., Austin, TX (USA)). 17 Apr 1980. 257p. NTIS, PC A12/MF A01.

The US Environmental Protection Agency has estimated that 28 states and the District of Columbia will need to implement vehicle Inspection/Maintenance (I/M) programs in order to comply with the Clean Air Act Amendments of 1977. In addition, several areas already have I/M programs. Each I/M program is unique. Its design is strongly influenced by the local economic and political factors and less so by the technical factors. However, in planning for an I/M program, there are basic issues that need to be addressed. The main intent of this study is to provide state agency administrators and technical personnel with information which will aid them in the implementation of an inspection/maintenance program. The report is divided into two sections: The first is a narrative discussion of the results of the survey. Section two contains tables that summarize the different aspects of an inspection/maintenance program.

28477 (PB—81-174724) United States: Canada memorandum of intent on transboundary air pollution, emissions, costs and engineering assessment. Work Group 3B report on strategies and implementation. (Environmental Protection Agency, Washington, DC (USA)). Feb 1981. 177p. NTIS, PC A09/MF A01.

Control technologies and their associated costs were investigated. Particular emphasis is placed on the problem of acid rain. Historical emission trends were reviewed and current emission rates from source regions are presented. Future emission rates under varying control and economic conditions are predicted.

28478 (PB—81-803850) Air pollution tracer studies in the lower atmosphere. 1964-February 1981 (citations from the NTIS Data Base). Report for 1964-Feb 1981. (National Technical Information Service, Springfield, VA (USA)). Feb 1981. 227p. NTIS PC N01/MF N01.

The cited reports cover research on the use of tracers to study lower atmospheric air pollution movements. The tracer used include sulfur hexafluoride, krypton 85, carbon 14, and other radioactive isotopes. The studies cite the results and techniques used, tracer movement from nuclear power plants, industrial stacks, urban areas, and the detectors used in their measurement. (This updated bibliography contains 220 citations, 23 of which are new entries to the previous edition.)

28479 (PB—82-114778) Walk-through survey report of G. M. Delco Battery Plant, Jersey Avenue, New Brunswick, N.J. Industrywide study. Donaldson, H. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA). Div. of Surveillance, Hazard Evaluation and Field Studies). Oct 1979. 8p. NTIS, PC A02/MF A01.

Worker exposures to lead (7439921) were surveyed at the General Motors Delco Battery Company (SIC-3691) in New Brunswick, New Jersey, on May 18, 1979. This company was under consideration for inclusion in a NIOSH study of the health status of workers exposed to less than 300 micrograms per cubic meter of airborne lead and with blood lead concentrations below 80 micrograms per 100 milliliters. The facility employed 600 workers who manufacture 12 volt lead and calcium automobile batteries. Ventilation, laundry, and cleanup facilities were adequate. The medical department was maintained by a doctor and two nurses. Environmental and blood samples were collected routinely, and workers were removed from jobs if their blood lead concentration exceeded 70 micrograms per 100 milliliters. A reclamation area was isolated from production areas, and employees in this area were provided with respirators. The author recommends that this facility be included in the proposed NIOSH study.

28480 (PB—82-117870) Determination of a range of concern for mobile source emissions of sulfuric acid. Harvey, C.A.; Garbe, R.J. (Environmental Protection Agency, Ann Arbor, MI (USA)). Aug 1981. 29p. NTIS, PC A03/MF A01.

This paper describes an effort by the Emission Control Technology Division of the EPA to establish a range of concern for sulfuric acid (H_2SO_4) emissions from mobile sources. In light of the action called for in section 202(a)(4) of the Clean Air Act (CAA) and due to a concern within industry as to what emission levels will be used as the basis for the evaluation of current and future technologies, a methodology was developed in order to bracket a range of concern for various unregulated pollutants. This paper coordinates the efforts from two EPA contracts in order to use this methodology specifically for an evaluation of sulfuric acid.

28481 (PB—82-118167) Approach for determining levels of concern for unregulated toxic compounds from mobile sources. Garbe, R.J. (Environmental Protection Agency, Ann Arbor, MI (USA)). Jul 1981. 42p. NTIS, PC A03/MF A01.

This report presents an approach for determining ranges of concern for vehicle emissions of toxic unregulated pollutants. The information used in deriving this approach was generated either in-house at EPA or under EPA contract to Midwest Research Institute in Kansas City, Missouri; and/or Southwest Research Institute in San Antonio, Texas. This work represents an EPA technical effort designed as one input that may bear on EPA policy with respect to implementation of section 202(a)(4) of the Clean Air Act amendments of 1977. As such, this report does not represent EPA policy at this time. This report will also be of interest to parties outside EPA, such as the automobile manufacturers, who are involved with deciding whether unregulated pollutants from motor vehicles constitute a public health hazard. This approach, outlined in the subsequent sections of this report, has four separate parts, the last of which is a summary of the previous three. An example of how the approach works is presented for a sample mobile source pollutant; sulfuric acid (H_2SO_4).

28482 (PB—82-120056) Determination of a range of concern for mobile source emissions of ammonia. Garbe, R.J. (Environmental Protection Agency, Ann Arbor, MI (USA)). Aug 1981. 34p. NTIS, PC A03/MF A01.

This paper describes an effort by the Emission Control Technology Division of the EPA to establish a range of concern for ammonia (NH3) emissions from mobile sources. In accordance with section 202(a)(4) of the Clean Air Act (CAA), and due to a concern within industry as to what emission levels will be used as the basis for the evaluation of current and future technologies, a methodology was developed in order to bracket a range of concern for various unregulated pollutants. This paper coordinates the efforts from two EPA contracts in order to use this methodology specifically for an evaluation of NH3. Mathematical models were previously designed or adjusted for various exposure scenarios (such as enclosed spaces, expressways, and street canyons) and were used to calculate the ambient air concentrations resulting from various mobile source NH3 emission factors. In conjunction with this, an NH3 health effects literature search was conducted to aid in the determination of the final range of concern. This search provides adequate evidence to support the chosen limits of the range.

28483 (PB—82-123712) Review of the literature and ongoing EPA projects comparing portable dosimeters and fixed site monitors as accurate indicators of exposure to carbon monoxide. Ader, A.W. (Environmental Protection Agency, Ann Arbor, MI (USA)). May 1981. 20p. NTIS, PC A02/MF A01.

This report will be primarily concerned with reviewing and evaluating previous studies comparing personal dosimeter readings and fixed site monitors. The secondary objective will be to assess the correlation, if any, of either or both of these monitoring techniques to various biological measurements of CO exposure including 'end-expired' breath analysis and blood carboxy-hemoglobin (COHb). An accurate assessment of the above parameters is essential especially in urban areas where CO levels above the National Ambient Air Quality Standard (NAAQS) of 10 mg/cu m (9 ppM) for an eight-hour limit and 40 mg/cu m (35 ppM) for a maximum one-hour limit have been reported.

28484 (PB—82-129578) Development of improved detection instruments for toxic gas contaminants in mining atmospheres. Open-file report, July 1979-January 1981. Kosek, J.A.; Gruber, A.H. (General Electric Co., Wilmington, MA (USA). Direct Energy Conversion Programs). Feb 1981. 116p. NTIS, PC A06/MF A01.

Work has been carried out under a Bureau of Mines contract to develop and fabricate gas sensors for mining applications. Promising new instruments have been designed, developed, tested, and supplied to meet Bureau requirements. These instruments include prototype (1) remote-sensing, diffusion-type CO monitors for mine operation that can be operated in conjunction with a surface computer, (2) control modules for alternate in-mine readout of the remote diffusion type CO monitors, (3) personal CO diffusion-type dosimeters, and (4) personal NO diffusion-type dosimeters. In addition, retrofit modifications were made to update and optimize operation of CO and NO_2 direct-reading type detectors provided under a previous contract. Studies were conducted to evaluate and demonstrate the availability of stable, portable NO_2 calibration sources for NO_2 instrumentation. The use of selected, commercially available cylinder sources for NO_2 instrument calibration were recommended. Additional studies were also conducted to investigate the feasibility of instrumentation for rapidly monitoring CO, NO, and NO_2 in diesel exhaust.

28485 Atmospheric deposition of metals to forest vegetation. Lindberg, S.E. (Oak Ridge National Lab., TN); Harriss, R.C.; Turner, R.R. *Science (Washington, D.C.);* **215**: 1609-1611(26 Mar 1982). Contract W-7405-ENG-26.

Atmospheric deposition during the growing season contributes one-third or more of the estimated total flux of lead, zinc, and cadmium from the forest canopy to soils beneath an oak stand in the Tennessee Valley but less than 10 percent of the flux of manganese. The ratio of the wet to dry deposition flux to the vegetation during this period ranges from 0.1 for manganese to 0.8 for lead to ~ 3 to 4 for cadmium and zinc. Interactions between metal particles deposited on dry leaf surfaces and subsequent acid precipitation can result in metal concentrations on leaves that are considerably higher than those in rain alone.

28486 Environmental impact of fuel changes in early London. Brimblecombe, P. (Univ. of East Anglia, England). pp 1-11 of Residential solid fuels: environmental impacts and solutions. Cooper, J.A.; Malek, D. (eds.). Beaverton, OR; Oregon Graduate Center (1982).

From 1981 international conference on residential solid fuels; Portland, OR, USA (1 Jun 1981).

In the historical context it is possible to see that pressures on fuel supplies provoke periods of air pollution crisis, but the perception of this pollution is sensitive more to the rapidity of change than the level of pollutant or environmental damage. The popular reaction is dependent on the economic and political relationships between the polluter and polluted. The air pollutant being more likely to be identified because it is unfashionable, than because it is a serious problem. The advocate of cleaner air who neglects these rather intangible aspects of air pollution finds seemingly rational proposals fail to make law or win public support.

28487 Inter-government research and development program for residential wood combustion. Osborne, M.C. (Environmental Protection Agency, Research Triangle Park, NC). pp 17-33 of Residential solid fuels: environmental impacts and solutions. Cooper, J.A.; Malek, D. (eds.). Beaverton, OR; Oregon Graduate Center (1982).

From 1981 international conference on residential solid fuels; Portland, OR, USA (1 Jun 1981).

This paper outlines the Wood Combustion Research Programs being funded by EPA, DOE, TVA, and the Canadian Government. Specific program areas are displayed in a flowchart according to categories which include air quality, emission measurement/combustion testing, equipment development, supporting technology and technology transfer. Project descriptions and program objectives are included along with projections concerning the emphasis of future research. A status report is also included on the progress of the Wood Combustion Research Group in establishing a set of standardized sampling and analysis procedures to be used by the different government agencies and their contractors in the sampling of wood stoves. In addition, the setting of acceptable operating limits on process variables during the performance of a standardized stove test is also addressed. A summary is given of current residential wood combustion research projects and their initial conclusions. An attempt is made at identifying data gaps which have become apparent during the overlaying of agency programs.

28488 Particulate emissions from new low emission wood stove designs measured by EPA method V. Kowalczyk, J.F.; Bosserman, P.B.; Tombleson, B.J. (Oregon Dept. of Environmental Quality, Portland). pp 54-78 of Residential solid fuels: environmental impacts and solutions. Cooper, J.A.; Malek, D. (eds.). Beaverton, OR; Oregon Graduate Center (1982).

From 1981 international conference on residential solid fuels; Portland, OR, USA (1 Jun 1981).

Particulate emissions from a typical welded steel airtight box stove were measured, then compared to six new wood heating device designs which showed promise of specifically reducing emissions. The test method used was EPA Method V with impingers and a backup filter. All tests were started with ignition of a typical full charge of Douglas fir. Testing continued until nearly complete burnout. This practice was followed to simulate a normal overnight burn or untended during-the-day normal firing practice. Results are reported in grams of particulates emitted per kilogram of wood burned. When compared to emission data gathered by other researchers, the airtight box stove had among the highest emissions. The two wood furnaces showed low emission performance while a gasifier and a catalytic stove as well as the prototype thermostat did not appear to offer any apparent emission reductions. A stack filter did achieve significant emission reduction for the one test run conducted on it. The major conclusion of this test program was that stove manufacturers still have considerable developmental work to do before a practical solution to the serious air pollution problem from wood heating can be claimed.

28489 Experimental measurements of emissions from residential wood-burning stoves. Hubble, B.R.; Stetter, J.R.; Gebert, E.; Harkness, J.B.L.; Flotard, R.D. (Argonne National Lab., IL). pp 79-138 of Residential solid fuels: environmental impacts and solutions. Cooper, J.A.; Malek, D. (eds.). Beaverton, OR; Oregon Graduate Center (1982).

From 1981 international conference on residential solid fuels; Portland, OR, USA (1 Jun 1981).

Organic emissions were measured from an air-tight, wood-burning stove operated in a manner consistent with typical residential heating requirements. Test data are reported for condensible organic and total organic emissions as a function of burn rate, and estimates of emission factors of individual organic compounds and compound classes are given. The principal finding is that potentially carcinogenic polycyclic organic material (POM) was emitted at both low and high burn rates, with large and small logs respectively. The condensible-organic emission factor increased, whereas the total-organics emission factor (includes particulates) decreased, as the burn rate and the firebox and stack-gas temperatures increased. A comparison of POM emissions suggested that faster burn rates with amall logs have higher POM emission factors than slower

burn rates with large logs. Furthermore, the POM emission factors observed in this study appear to be markedly lower than those previously reported in the literature. These findings, in combination with published results, show that concerns over the potential health effects of increased usage of residential, wood-burning stoves have not yet been resolved and that greater emphasis should be placed on the quantitative determination of POM emission factors at low burn rates typical of residential use.

28490 **Characterization of emissions from residential wood combustion sources.** Cooke, W.M. (Battelle-Columbus Labs., OH); Allen, J.M.; Hall, R.E. pp 139-163 of Residential solid fuels: environmental impacts and solutions. Cooper, J.A.; Malek, D. (eds.). Beaverton, OR; Oregon Graduate Center (1982).

From 1981 international conference on residential solid fuels; Portland, OR, USA (1 Jun 1981).

The purpose of this study was to investigate combustion modification techniques that might be beneficially applied to wood stoves, specifically to identify those techniques which hold promise of providing a significant improvement in emissions from residential wood combustion. Three commercial stoves were tested under different burn modes. Stove operating conditions included up draft using a grate, up draft using a hearth, cross draft, down draft, and a high turbulence mode utilizing a forced draft blower. Several fuels were tested including commercial oak cord wood, commercial green pine cord wood, oven-dried fir brands, and naturally dried oak cut into reproducible triangles. Continuous flue gas measurements taken during the burn cycle included O_2, CO_2, CO, NO, SO_2, and total hydrocarbons (THC). In addition, discrete samples of flue gas were collected throughout several runs by a Modified Method 5 sample train. These gas and particulate samples were analyzed for a series of PAH compounds using high resolution, glass capillary gas chromatography and coupled mass spectrometry. Emission of total PAH and benzo(a)pyrene are reported relative to flue gas composition and burning mode. Several combustion modification techniques were identified which have an appreciable effect on emission and, therefore, can be developed and applied to reduce emissions in consumer use. The more promising design modifications include: prevention of heating wood inventory in the stove, direction of the air supply into primary and secondary burning areas with high turbulence, increases in the temperatures in secondary burning regions of the appliances, and any means of increasing the effectiveness of secondary combustion.

28491 **Characterization of emissions from wood-burning fireplaces.** Muhlbaier, J.L. (General Motors Research Labs., Warren, MI). pp 164-187 of Residential solid fuels: environmental impacts and solutions. Cooper, J.A.; Malek, D. (eds.). Beaverton, OR; Oregon Graduate Center (1982).

From 1981 international conference on residential solid fuels; Portland, OR, USA (1 Jun 1981).

Wood-burning emissions were collected and characterized from a freestanding fireplace installed in the laboratory. Under the burning conditions used in this study, particle emissions averaged 12 g/kg of wood burned from softwoods, 10 g/kg from hardwoods, and 19 g/kg from synthetic logs. Organic emissions increased with larger log sizes. Higher particle emissions were measured from dry wood. The particles were spheres and clusters of spheres with a mass median diameter of 0.17 micrometer. Gas emissions averaged 110 g/kg CO, 1.5 g/kg HC, and 0.7 g/kg NO/sub x/ from natural woods. Particles, elemental carbon, CO_2, NO/sub x/, and hydrocarbon emissions peaked when the temperature was the highest. Carbon monoxide emissions were more variable. Although wood burning accounts for only 3% of residential and commercial fuel usage, it is responsible for 53% of the particles and 85% of CO emissions from all residential combustion sources.

28492 **Particulate emissions from residential wood combustion in Vermont.** Sanborn, C.R.; Blanchet, M.A. (Vermont Air Pollution Control Program, Montpelier). pp 188-198 of Residential solid fuels: environmental impacts and solutions. Cooper, J.A.; Malek, D. (eds.). Beaverton, OR; Oregon Graduate Center (1982).

From 1981 international conference on residential solid fuels; Portland, OR, USA (1 Jun 1981).

As part of the Agency's residential woodburning study in Waterbury, fourteen woodburning appliances were tested to determine a useable particulate emission rate for woodburning appliances. A full range of wood combustion sources; airtight stoves, parlor stoves and box stoves as well as wood furnaces, were tested using either the EPA Method 5 test train or a high-volume sample train. All tests were conducted on residential woodburning appliances, operated in the owners home at what the owners considered normal operating conditions. The fuel used consisted of various species of seasoned hardwoods. The particulate emissions ranged from 6.6 to 42.3 g/kg of fuel. Condensable organics comprised 15 to 64% of the total weight, averaging 37%. Since the flue gas velocity was not always directly measurable, the stoichiometric equations were used in conjunction with the fuel usage and flue gas analysis to calculate the volume of gas emitted. The results of the tests were used to develop a particulate emission factor for residential woodburning. Used in conjunction with a village wide fuel survey the total particulate impact from residential woodburning was determined for Waterbury, Vermont.

28493 **Wood combustion emissions at elevated altitudes.** Peters, J.A.; Hughes, T.W.; DeAngelis, D.G. (Monsanto Research Corp., Dayton, OH). pp 199-209 of Residential solid fuels: environmental impacts and solutions. Cooper, J.A.; Malek, D. (eds.). Beaverton, OR; Oregon Graduate Center (1982).

From 1981 international conference on residential solid fuels; Portland, OR, USA (1 Jun 1981).

Combustion of wood in fireplaces and in wood-burning stoves is growing in popularity as the cost for other fuel sources increases. The growing use of wood combustion for aesthetic reasons and for primary and secondary home heating has attracted widespread environmental concern due to its increased particulate, carbon monoxide and polycyclic organic material (POM) emissions over other residential fuel types. A recent study conducted for the US Environmental Protection Agency indicated that residential wood combustion is the largest stationary source of POM emissions. Recently, high levels of particulates and POM's have been found in mountainous resort areas. Local EPA officials are concerned that woodstoves operated at high elevations result in significantly higher pollutant emissions than stoves operatedat lower elevations. The EPA conducted a study quantifying high elevation emissions; this paper presents the results of the study.

28494 **Effects of woodstove design and operation on condensable particulate emissions.** Barnett, S.G.; Shea, D. (State Univ. of New York, Plattsburgh). pp 227-266 of Residential solid fuels: environmental impacts and solutions. Cooper, J.A.; Malek, D. (eds.). Beaverton, OR; Oregon Graduate Center (1982).

From 1981 international conference on residential solid fuels; Portland, OR, USA (1 Jun 1981).

The authors have developed a simple effective and low cost technique to measure condensable particulates in woodstove flue gases. A high volume sampler was designed which concentrates flue gas particulates on filter paper. Room air bleeds into the sampler tube, cooling flue gases, and thereby insuring complete condensation of the flue gases into droplet form before they reach the filter paper. Flow rates of both flue and sampler were monitored. After months of testing different flowmeters, the Teledyne Hastings Raydist (PCI-30) thermopile type flowmeter was found to produce the most reliable measure of flue gas velocity without being affected by either high temperature or by liquid flue gas droplets. Emission tests were made using native hardwoods of 4 to 6 inch diameter with an oven dry basis moisture content of 30 to 40% (average for home use). Results are included of an investigation of wood burning rates encountered in 10 homes in northernmost New York. Average burn rate was found to be only 3.5 pounds per hour. In accordance with these results our emissions tests were made at burning rates averaging about 4 pounds per hour and ranging from 1.5 to 6 pounds per hour.

28495 POM emissions from residential woodburning: an environmental assessment. Peters, J.A. (Monsanto Research Corp., Dayton, OH). pp 267-288 of Residential solid fuels: environmental impacts and solutions. Cooper, J.A.; Malek, D. (eds.). Beaverton, OR; Oregon Graduate Center (1982).

From 1981 international conference on residential solid fuels; Portland, OR, USA (1 Jun 1981).

Because of the rapid growth of woodburning for home heating and aesthetic purposes, both regional and national EPA officials have become concerned over the potential environmental effects of residential combustion of wood. Various organic species including POM (polycyclic organic matter) compounds are probably the most environmentally significant pollutants from residential wood combustion, although previous emission measurements have done little to identify or quantify them. This paper presents some of the results of a test program conducted by the EPA, Monsanto Research Corporation, and Auburn University to characterize emissions from wood-burning equipment, specifically two air-tight stoves and heat-circulating fireplace while burning four varieties of wood. POM's were collected using a modified EPA Method 5 train and a SASS train. Samples for bioassay were collected with the SASS train; all of the SASS train samples showed mutagenic activity (with the Ames test) and also exhibited high to moderate toxicity by the CHO-cell tissue assay. Ash samples showed no mutagenic response and exhibited either no toxicity or low toxicity. Over 75 organic compounds were identified and quantified upon characterization of the organic material present in the flue gas; 22 of these were POM's. The POM's accounted for up to about 35% of the mass of organics identified by GC/MS. However, in most cases, over 50% of the organic material collected was nonchromatographable.Compilation of an emission inventory for POM's indicates that residential wood burning may be the largest source of POM's emitted to the atmosphere, including both stationary, non-stationary, and natural sources.

28496 Particulate emission factors for small wood and coal stoves. Butcher, S.S. (Bowdoin Coll., Brunswick, ME); Ellenbecker, M.J. pp 289-303 of Residential solid fuels: environmental impacts and solutions. Cooper, J.A.; Malek, D. (eds.). Beaverton, OR; Oregon Graduate Center (1982).

From 1981 international conference on residential solid fuels; Portland, OR, USA (1 Jun 1981).

Emission factors for particulate matter and carbon monoxide have been measured for wood, anthracite coal and bituminous coal burned in residential heaters operated at less than 15 kw (50,000 Btu/hr). In these studies the stove effluent is mixed with about four volumes of outside air and samples are collected about two minutes after mixing. The main purpose of using this sampling method is to more closely simulate atmospheric conditions. Particulate samples are collected on 20 x 25 cm filters after cyclone preseparation of particles larger than 4 μm. Carbon monoxide concentrations are measured with Draeger tubes. Particulate emission factors for wood ranged from 1.6 to 6.4 g/kg(fuel) and were found to depend on the fuel load and the firing rate, as indicated by earlier studies. These values are substantially less than the values obtained previously for stoves operated under similar conditions. The average particulate emission factors for bituminous and anthracite coal are 10.4 and 0.50 g/kg, respectively. The bituminous coal figure must be qualified at this point as this fuel was burned in a stove designed for anthracite use. Carbon monoxide emission factors for wood, bituminous, and anthracite coal are 100, 116, and 21 g/kg, respectively. The results are discussed and compared with other cooled gas sampling results and also with results obtained using the EPA Method 5.

28497 Chemical and physical methods of apportioning the contributions of emissions from residential solid fuels to reductions in air quality. Cooper, J.A. pp 349-364 of Residential solid fuels: environmental impacts and solutions. Cooper, J.A.; Malek, D. (eds.). Beaverton, OR; Oregon Graduate Center (1982).

From 1981 international conference on residential solid fuels; Portland, OR, USA (1 Jun 1981).

Methods of apportioning the contributions of air particulate sources to total suspended particulate levels include: emission inventory methods; source-dispersion models; and receptor models. Each approach represents a tool which can be used to develop circumstantial information relating a source to its impact. Each airshed and set of sources presents a unique set of requirements which must be addressed if the most cost effective source apportionment program is to be developed. Usually, a variety of information gathering methods will be required to develop the confidence required to support effective action. Residential wood combustion emissions which are addressed include: carbon monoxide; hydrocarbons; particles; and other hazardous pollutants such as polynuclear aromatic hydrocarbons, etc. The strengths and limitations of each of the three approaches are discussed as they relate to these pollutants. Problems related to developing accurate emission inventories as well as chemical fingerprints, are presented. Special approaches, such as radiocarbon analysis and chemical mass balance methods are reviewed. Procedures for developing more cost-effective source apportionment tools through, for example, the compositing of samples and regime stratification, are also considered.

28498 Radiocarbon: nature's tracer for carbonaceous pollutants. Currie, L.A.; Klouda, G.A.; Gerlach, R.W. (National Bureau of Standards, Washington, DC). pp 365-385 of Residential solid fuels: environmental impacts and solutions. Cooper, J.A.; Malek, D. (eds.). Beaverton, OR; Oregon Graduate Center (1982).

From 1981 international conference on residential solid fuels; Portland, OR, USA (1 Jun 1981).

Recent developments in radiocarbon dating techniques have made it feasible to determine $^{14}C/^{12}C$ ratios in samples containing milligram or even microgram quantities of carbon. As a result, it has become practicable to apply these techniques to the study of trace gases and particles in the atmosphere, as a means of resolving anthropogenic from natural source components. Interpretation of ^{14}C data is straightforward: biospheric carbon (such as vegetation) is alive with a $^{14}C/^{12}C$ ratio of about 1.5×10^{-12}, whereas fossil carbon is dead. Beyond this dichotomous classification it becomes very interesting to combine the isotopic data with concurrent chemical data, as well as spatial and temporal distributions, in order to infer the strengths of specific sources of carbonaceous pollutants. A brief review will be presented of our program on atmospheric gases and carbonaceous particles. For the latter, we have assayed individual chemical and size fractions, and samples collected in urban, rural, and remote locales. The biogenic carbon fraction - presumably from wood-burning - ranged from 10% to 100% for the urban samples analyzed.

28499 Contribution of residential wood combustion local airshed pollutant concentrations. Meyer, H.R. (Oak Ridge National Lab., TN). pp 386-397 of Residential solid fuels: environmental impacts and solutions. Cooper, J.A.; Malek, D. (eds.). Beaverton, OR; Oregon Graduate Center (1982). Contract W-7405-ENG-26.

From 1981 international conference on residential solid fuels; Portland, OR, USA (1 Jun 1981).

For a variety of economic, political, and supply-related reasons, a resurgence in the use of residential wood combustion (RWC) for primary and secondary heating is currently occurring in the United States. While there are a number of positive aspects to this trend, the displacement of oil, gas, and electricity as residential heat sources will result in locally increased peak and annual-average air concentrations of certain pollutants. Carbon monoxide (CO), polycyclic organic materials, (POM), respirable particulates, and other hazardous materials are emitted via RWC directly into the local environment at rates greatly exceeding those associated with residential use of oil or gas. This study, conducted at Oak Ridge National Laboratory, has developed models to estimate both worst-case and seasonal-average air concentrations of key RWC emissions for representative US locations. Model results are compared to available measurements of ambient and RWC-specific concentrations. Acute episodal predictions are found to exceed US Environmental Protection Agency 24-hour standards for particulates, and to approach the eight-hour CO standards. By indexing to benzo(a)pyrene, POM concentration estimates are cautiously related to potentially increased population health effects, specifically pulmonary carcinomas. The need for additional data collection and assessment work is emphasized.

28500 **Residential indoor and matched outdoor pollutant measurements with special consideration of wood-burning homes.** Colome, S.D. (Univ. of California, Irvine); Spengler, J.D. pp 435-455 of Residential solid fuels: environmental impacts and solutions. Cooper, J.A.; Malek, D. (eds.). Beaverton, OR; Oregon Graduate Center (1982).

From 1981 international conference on residential solid fuels; Portland, OR, USA (1 Jun 1981).

Results are presented for trace-element determinations of respirable (3.5 μm 50% cut-off) aerosols for five homes each in Steubenville, Ohio and Portage, Wisconsin. Sampling was conducted every twelfth day for one year during 1978 and 1979 and is matched within residence and immediately outside and across the five home sites in each city. A total of approximately 600 samples have been analyzed by instrumental neutron activation analysis and separately for mass, water soluble sulfates, SO_2 and NO_2. While not designed to investigate the influence of solid residential fuel, two of the homes in Portage use wood for primary heating. Across the full set of homes the indoor concentrations of SO_4 Mn and V were generally related to the matched outdoor observations. Concentrations of other parameters measured showed less relationship and indicated the presence of indoor sources. Homes in which wood was used for heating tended to have a weak indoor excess of Al, Cl, Mn and possibly Br. This could have been due to other, unidentified, indoor sources. Modification of exposure to outdoor pollutants by indoor environments has implications for epidemiologic investigations of air pollution.

28501 **Study of occupant exposure to particulates and gases from woodstoves in homes.** Benton, G.; Miller, D.P.; Reimold, M.; Sisson, R. (Washburn Univ., Topeka, KS). pp 456-468 of Residential solid fuels: environmental impacts and solutions. Cooper, J.A.; Malek, D. (eds.). Beaverton, OR; Oregon Graduate Center (1982).

From 1981 international conference on residential solid fuels; Portland, OR, USA (1 Jun 1981).

The air within five rural Kansas homes which used wood fuel was sampled for particulates and gases during the 1980 heating season. The mass respirable particulates levels in the five homes were found to be higher than average for this area. The gases ranged from near zero to a substantial level. Each home had a unique set of components which remained consistent throughout the study. The components identified appeared to be dependent on the type of wood burning device used.

28502 **New techniques for identifying ambient air impacts from residential wood heating.** Kowalczyk, J.F.; Greene, W.T. (Oregon Dept. of Environmental Quality, Portland). pp 469-494 of Residential solid fuels: environmental impacts and solutions. Cooper, J.A.; Malek, D. (eds.). Beaverton, OR; Oregon Graduate Center (1982).

From 1981 international conference on residential solid fuels; Portland, OR, USA (1 Jun 1981).

The Oregon Department of Environmental Quality first identified the significance of impacts from residential wood heating upon reviewing the results of the Portland Aerosol Characterization Study conducted in 1977 to 1979. Since then further substantial efforts have been undertaken to more accurately assess impacts not only in the Portland area but also in other areas of the state including Medford and Bend. Chemical Mass Balance techniques have been primarily relied upon to define impacts with substantial source testing conducted to identify the best estimate of the chemical element fingerprint for Oregon wood heating emissions. Other techniques employed included carbon dating of ambient filters, pattern recognition analysis based on nephelometer (light scattering) curve distortion analysis, carbon compound thermal gradient measurements, computer modeling and statistically designed surveys of actual wood usage. Complex airshed models were used to evaluate results and project future impacts from this rapidly growing source. All results confirm residential wood heating can have substantial ambient impacts on given days and confirm that on an annual basis wood space heating is generally the second largest identifiable source of total suspended particulate and the largest source of respirable (<2.5 microns) particulate. A new emission factor for the Medford area of 20 grams/kilogram for wood burned has been derived from the ambient air impact analysis.

28503 **Ambient particulate and benzo(α)pyrene concentrations from residential wood combustion, in a mountain resort community.** Murphy, D.J. (Colorado State Univ., Fort Collins); Buchan, R.M.; Fox, D.G. pp 495-505 of Residential solid fuels: environmental impacts and solutions. Cooper, J.A.; Malek, D. (eds.). Beaverton, OR; Oregon Graduate Center (1982).

From 1981 international conference on residential solid fuels; Portland, OR, USA (1 Jun 1981).

Total suspended particulates and benzo(α)pyrene concentrations were highest in the center of town, averaging 61 $\mu g/m^3$ and 7.4 ng/m^3 respectively. The mean BaP level of 7.4 ng/m^3 appears to be several times greater than what is expected in a major metropolitan area. Residential wood combustion is suspected as the primary source of BaP in this community.

28504 **Ambient air assessment in rural village and small town locations in New Hampshire where wood is an important fuel.** Hornig, J.F. (Dartmouth Coll., Hanover, NH); Soderberg, R.H.; Larsen, D.; Parravano, C. pp 506-519 of Residential solid fuels: environmental impacts and solutions. Cooper, J.A.; Malek, D. (eds.). Beaverton, OR; Oregon Graduate Center (1982).

From 1981 international conference on residential solid fuels; Portland, OR, USA (1 Jun 1981).

During the 1979 to 1980 heating season, fifty standard hi-vol filter samples of ambient air particulates were taken in a residential neighborhood in Hanover, a small New Hampshire town where wood is an important supplementary fuel, and in Lyme Center, a semi-rural village where wood is the dominant heating fuel. In addition to total suspended particulate (TSP) values, concentrations of 12 polycyclic organic materials (POM), 10 of which are priority pollutants, were determined using HPLC with uv and fluorescence detection, and by GC/MS techniques. Concentrations of benzo(a)pyrene were found to be in the range 0.40 to 2.97 ng/m^3 (mean = 1.62) in Hanover and 0.18 to 1.23 ng/m^3 (mean = 0.48) in Lyme Center. Our measurements are compared to recently published POM values from diverse sources, and we discuss troublesome methodological problems which potentially compromise ambient air POM analyses.

28505 **Preliminary report on a study of the ambient impact of residential wood combustion in Petersville, Alabama.** Imhoff, R.E. (Tennessee Valley Authority, Muscle Shoals, AL); Manning, J.A.; Cook, W.M.; Hayes, T.L. pp 520-538 of Residential solid fuels: environmental impacts and solutions. Cooper, J.A.; Malek, D. (eds.). Beaverton, OR; Oregon Graduate Center (1982).

From 1981 international conference on residential solid fuels; Portland, OR, USA (1 Jun 1981).

The impact of residential wood combustion on ambient air quality was studied in an intensive field investigation conducted January 28 to February 14, 1981. Ambient concentrations of several pollutants and source markers were measured during nine 6-hour sampling periods in and downwind of a small residential community located in rolling terrain. Results of a single sampling period are reported in this paper. Concentrations calculated by an area-source dispersion model are compared with the measured concentrations. Data collected by two mobile sampling vans and a mobile meteorological station were analyzed to quantify the concentrations of polynuclear aromatic hydrocarbons and other organic compounds present in the ambient air within and upwind of the town. Other analyses are in progress. Ground-level and aerial surveys determined that of 1200 homes in the study area, 900 had wood burning devices. High concentrations of particulates and organic materials were measured on clear nights. An increase of the benzo(a)pyrene (BaP) concentrations by 80 nanograms per cubic meter above background was measured. Since much of the BaP was in the gaseous phase, and previous studies measured only the aerosol phase, previous assessments of BaP concentrations may be low by a factor of 2 to 3.

28506 **Residential wood combustion in Missoula, Montana: an overview of its air pollution contributions, health effects, and proposed regulatory solutions.** Carlson, J.H. (Missoula City-County Health Dept., MT). pp 539-550 of Residential solid fuels: environmental impacts and solutions. Cooper, J.A.; Malek, D. (eds.). Beaverton, OR; Oregon Graduate Center (1982).

From 1981 international conference on residential solid fuels; Portland, OR, USA (1 Jun 1981).

In the past decade, residential wood combustion (RWC) has replaced industry as the largest contributor to Missoula's wintertime air pollution problem. Recent studies indicate that RWC is responsible for approximately 55 percent of wintertime TSP and 75 percent of wintertime RSP. Pulmonary function testing indicates that TSP in Missoula at annual average levels of 80 to 90 $\mu g/m^3$ cause measurable health effects in grade school students and in persons with chronic obstructive pulmonary disease. Microbial bioassay tests have indicated that Missoula particulate contains elevated levels of mutagenic substances which are attributed to wood combustion. Missoula citizens have exhibited concern over air quality, and surveys indicate that governmental efforts are necessary to alleviate the problem. Citizen groups and Health Department staff have proposed increased public education efforts and stringent emission standards for the installation of new wood-burning devices.

28507 **Historic changes in air pollution in Great Britain.** Lawther, P.J. (St. Bartholomew's Hospital Medical Coll., London, England). pp 566-576 of Residential solid fuels: environmental impacts and solutions. Cooper, J.A.; Malek, D. (eds.). Beaverton, OR; Oregon Graduate Center (1982).

From 1981 international conference on residential solid fuels; Portland, OR, USA (1 Jun 1981).

Complaints about the noxious effects of pollution of the air by coalsmoke are on record since the 14th century. The pamphlet Fumifugium addressed by John Evelyn to Charles II describes the problem in almost as much detail as do latter works such as the Report of the Beaver Committee which was set up after the infamous fumigation known as The London Smog of 1952. The recommendations of the Committee were to form the basis of the Clean Air Act of 1956, the implementation of which has led to spectacular reductions in the classic pollutants - smoke and sulfur dioxide. There used to be no difficulty in demonstrating the ill effects of air pollution on health by showing associations between indices of pollution and mortality and morbidity. Now, by virtue of the decline in pollution brought about mainly by the increase in the efficiency with which coal and other fuels are burned, such effects are no longer discernible.

28508 **Quantitative impact of residential wood combustion and other vegetative burning sources on the air quality in Medford, Oregon.** DeCesar, R.T.; Cooper, J.A. (Oregon Graduate Center, Beaverton). pp 551-565 of Residential solid fuels: environmental impacts and solutions. Cooper, J.A.; Malek, D. (eds.). Beaverton, OR; Oregon Graduate Center (1982).

From 1981 international conference on residential solid fuels; Portland, OR, USA (1 Jun 1981).

Chemical mass balance methodology was employed to quantitatively assess the impact of vegetative burning sources on the Medford, Oregon air quality. Vegetative burning (residential wood combustion, backyard burning, field burning, forest fires, etc.) was identified as the largest contributor to Medford's TSP (31%) and respirable particles (66%). The Medford AQMA emission inventory suggests that residential wood combustion is the major source of vegetative burning emissions. Supporting the emission inventory is the fact that vegetative burning impacts as percent of TSP are three times higher during the fall and winter compared to the summer and spring. An intensive sampling study during the 1979 Christmas holiday period showed residential wood combustion impacts as high as 126 $\mu g/m^3$. The methodology and results of this study will be illustrated and discussed relative to their application to control strategies in Medford and their general applicability to other airsheds.

28509 **Data base of organic pollutants that have been evaluated for carcinogenicity and mutagenicity.** Kelsey, M.I. (National Cancer Inst., Bethesda, MD); Kraybill, H.F.; Helmes, C.T.; Sigman, C.C. pp 577-605 of Residential solid fuels: environmental impacts and solutions. Cooper, J.A.; Malek, D. (eds.). Beaverton, OR; Oregon Graduate Center (1982).

From 1981 international conference on residential solid fuels; Portland, OR, USA (1 Jun 1981).

The Office of Environmental Cancer at the National Cancer Institute is interested in the problems of stress from multiple environmental pollutants and is concerned with the potential carcinogenicity of organic air pollutants. A data base of such compounds consists of summary tables of chemicals that were actually measured as airborne pollutants and which have been tested for carcinogenicity and mutagenicity. This data base was then grouped into four categories as follows: (1) recognized carcinogens, (2) suspect carcinogens, (3) tumor promoters and cocarcinogens, and (4) mutagens, according to definitions which will be described in the text. In the recognized carcinogens category there were 25 compounds which were mainly halogenated aliphatic and polycyclic aromatic hydrocarbons. Of the 20 suspect carcinogens group, half of the compounds were either halogenated aliphatic or polycyclic aromatic hydrocarbons. The 15 cocarcinogens were alkane, phenol and polycyclic aromatic hydrocarbons. Finally, the mutagens (50) represented 12 chemical classes with the majority identified as polycyclic aromatic hydrocarbons, halogenated aliphatic hydrocarbons, N-heterocyclics, and vinyl halides. This data base of organic air pollutants will be used as a resource to identify potential carcinogens in ambient air.

28510 **Health effects of residential wood combustion: the implications of environmental stochasticity.** Morris, G. (Univ. of California, Berkeley). pp 648-656 of Residential solid fuels: environmental impacts and solutions. Cooper, J.A.; Malek, D. (eds.). Beaverton, OR; Oregon Graduate Center (1982).

From 1981 international conference on residential solid fuels; Portland, OR, USA (1 Jun 1981).

Rapidly rising costs for conventional energy sources have provided the impetus for a large-scale resurgence of wood as a residential fuel in the United States. Wood combustion, however, may entail significant health costs for society. Characterizing and quantifying the costs associated with wood combustion is fraught with uncertainty. One important source of uncertainty results from our tenuous understanding of the links between pollutant emissions and ambient pollutant concentrations. Pathways of dispersion and conversion of air pollutants depend on the vagaries of weather, so environmental stochasticity is an important factor in determining the ultimate impact of residential wood combustion. This paper explores some of the implications that natural environmental stochasticity has for the health effects of residential wood combustion. A survey of the characteristics of winter climates in various regions of the US leads to some preliminary generalizations about the chances for severe impacts from residential wood combustion. Since wood burning is only one of many means that home owners have for reducing their use of expensive conventional fuels, the implications that other heating technologies have for influencing the health impacts of wood combustion are also examined. Finally, possibilities are explored for controlling the effects of residential wood combustion by using regulations that are sensitive to stochastic environmental parameters.

28511 **Formation of submicron ash particles in coal combustion.** Faist, M.B.; Davidovits, P. (Aerodyne Research, Inc., Bedford, MA). pp 808-831 of Residential solid fuels: environmental impacts and solutions. Cooper, J.A.; Malek, D. (eds.). Beaverton, OR; Oregon Graduate Center (1982). Contract AC21-79-MC-11783.

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A large fraction of the airborne particles produced during coal combustion is submicron sized. These small particles which unfortunately cannot be removed easily from the exhaust stream present a serious environmental and materials hazard. The mechanism for the formation of submicron particles is still in doubt. Most fre-

quently, it is assumed that the submicron particles are formed by homogeneous condensation of volatilized matter. However, the results of chemical analyses for such particles seem to contradict this formation mechanism. In the previous treatments of the submicron particle formation process, it was assumed that the condensation of coal ash vapor was purely homogeneous, that is, heterogeneous condensation of ash vapor on the larger suspended ash particles could be neglected. A more detailed analysis of the collision process indicates that, in the early stages of the homogeneous condensation, the sticking coefficient is very small and, as a result, heterogeneous condensation cannot be neglected. In order to clarify the process of submicron particle formation, we have developed a model which includes both homogeneous condensation and condensation of the ash vapor on the suspended particles. The equations describing the process include a sticking coefficient which depends on the mass of the colliding particles. The results of the calculations show the conditions under which heterogeneous condensation determines the fate of the vaporized ash, and also establishes the conditions where homogeneous condensation may dominate, producing submicron particles via that pathway.

28512 **Catalysis of woodstove effluent.** Jaasma, D.R. (Virginia Polytechnic Inst. and State Univ., Blacksburg). pp 832-850 of Residential solid fuels: environmental impacts and solutions. Cooper, J.A.; Malek, D. (eds.). Beaverton, OR; Oregon Graduate Center (1982).

From 1981 international conference on residential solid fuels; Portland, OR, USA (1 Jun 1981).

An analytical and experimental study of woodstove effluent catalysis is described. Calculations of equilibrium species concentrations of NH_3, HCN, and C_2N_2 were performed for 27 conditions which could conceivably result from catalysis of stove effluent. Appreciable quantities of NH_3 and HCN are predicted for fuel-rich mixtures. Measurements of chemical changes, temperature rise, and pressure drop due to passage of effluent through noble-metal coated beads are reported. For in-stack catalyst tests using 0.05% precious metal beads, conversion efficiencies based on CO oxidation were approximately 90% for green oak and dry hickory combustion when the catalyst approach stream temperature was greater than 350°C. The CO emission factors typically ranged from 1 to 13 g/kg. Detector tubes were used to screen for the presence of HCN and NH_3 in the gas downstream of the catalyst, and none was found. Tests were also run using Pt spheres in the stove, giving CO emission factors on the order of 50 g/kg. Detector tube screening gave no indication of HCN or NH_3 emissions, but these results should be confirmed by more sophisticated tests. The relatively poor performance of the beads was apparently due to shifting of the beads to give a shallow section of bed through which the gas flowed preferentially.

28513 **Institutional and regulatory approaches to control residential wood burning emissions.** Greene, W.T.; Tombleson, B.J. (Oregon Dept. of Environmental Quality, Portland). pp 1229-1252 of Residential solid fuels: environmental impacts and solutions. Cooper, J.A.; Malek, D. (eds.). Beaverton, OR; Oregon Graduate Center (1982).

From 1981 international conference on residential solid fuels; Portland, OR, USA (1 Jun 1981).

After an introduction on the severity of pollution impacts from residential wood heating in Oregon, different potential institutional and regulatory approaches to control pollution from this emission source are discussed. Approaches include performance rating certification programs, programs which certify compliance with standards, weatherization programs to reduce heating needs, educational programs, governmental efficiency/emissions/safety inspection programs as in West Germany, and government or trade association research programs to develop improved emission control techniques. The importance of developing a simpler, yet repeatable, emissions measurement method is emphasized.

28514 **(DOE/EV/04708—T1) Monitoring airborne particulates and gases.** Heistand, R.N.; Jones, D.B. (Development Engineering, Inc., Grand Junction, CO (USA)). [nd]. Contract AC02-78EV04708. 62p. NTIS, PC A04/MF A01. Order Number DE81023358.

04.

Gaseous and particulate emissions were monitored for two-week periods at each of the following Anvil Points locations: mine, crusher, retort and shale disposal areas. Gases appear to be normal ambient air. No CO, hydrocarbons, NO/sub x/, SO_2, $As(AsH_3)$, Hg, Pb, or Se were detected. Except when the monitoring sites were very close to moving equipment, particulate loadings were fairly low (1 to 10 mg/M^3), and the mean particle size was generally within the 1 to 10 micron range. Bimodal particle size distribution was generally observed which would indicate that significant amounts of the particulates fell both above and below this range.

5003 Radioactive Materials Monitoring And Transport

REFER ALSO TO CITATION(S) 28029, 28180, 28438, 28530, 28531, 28532, 28533

28515 **(LBL—11052) Radon-daughter exposures in energy-efficient buildings.** Nero, A.V.; Berk, J.V.; Boegel, M.L.; Hollowell, C.D.; Ingersoll, J.G.; Nazaroff, W.W. (Lawrence Berkeley Lab., CA (USA)). Oct 1981. Contract W-7405-ENG-48. 10p. (CONF-800398—4). NTIS, PC A02/MF A01. Order Number DE82003711.

From Specialist meeting on assessment of radon and daughter exposure and related biological effects; Rome, Italy (3 Mar 1980).

A radon concentration of 1 pCi/l (37 Bq/m^3) appears to lie in the range that is typical for air inside US residential buildings. Moreover, some US residences have concentrations higher than 1 pCi/l, sometimes by an order of magnitude, implying significant individual risk to occupants. For typical radon daughter equilibrium ratios, this concentration corresponds to a radon daughter exposure rate of 0.2 working level months (WLM) per year. This exposure rate may account for a significant lung cancer incidence if data on lung cancers per unit exposure in miners are applicable to such low exposures. Reductions in air exchange rates may rise the typical exposure rate and even increase it to unacceptable levels in some cases. Measures that reduce energy use by reducing natural infiltration or mechanical ventilation in new or retrofit buildings are therefore undergoing severe scrutiny. Lawrence Berkeley Laboratory has performed measurements in buildings specifically designed to use energy efficiently or utilize solar heating. In many of these buildings radon concentrations appear to arise primarily from soil underlying the buildings. Measures to control higher levels, e.g., by mechanical ventilation with heat recuperation, appear to be economical. However, to evaluate energy-saving programs adequately requires a much more comprehensive characterization of radon sources (for example, by geographical area) and a much fuller understanding of the dynamics of radon and its daughters indoors than now exist.

28516 **Calculation of wet deposition from radioactive plumes.** Brenk, H.D.; Vogt, K.J. *Nuclear Safety;* 22: No. 3, 362-371(May 1981).

A reevaluation of the current wet deposition models for radioactive plumes of the Gaussian type is presented. The application of the methodology to routine and accidental activity releases from nuclear facilities is discussed. A set of washout parameters for a simplified model has been included.

28517 **(ORNL-tr—4795) Experimentally determined dispersion parameters in the Federal Republic of Germany for emisson heights of 100 m.** Geiss, H.; Nester, K.; Thomas, P.; Vogt, K.J. (Oak Ridge National Lab., TN (USA)). Feb 1981. Contract W-7405-ENG-26. Translation of Report No. 1707 of the Kernforschungsanlage Juelich and Report No. 3095 of the Kernforschungszentrum Karlsruhe, February 1981. 30p. NTIS, PC A03/MF A01. Order Number DE82003518.

Comparative studies of the results of the Juelich and Karlsruhe diffusion experiments applicable to 100 m source height have shown that a combination of both experimental series is justified. Following a short description of the experimental performance the determination of the dispersion parameters at both sites will be explained. A method has been developed to combine and smooth these parameters. The method is described and illustrated by dia-

grams. The results have been compared with the St. Louis and Brookhaven data. The comparison has made evident that the dispersion parameters set up experimentally at the US-sites yield comparable results in part only. This means that they can hardly be applied to sites in the Federal Republic of Germany.

5006 Regulations

REFER ALSO TO CITATION(S) 27800, 27815, 27817, 28238

28518 **(PB—81-150864) Study of the 1979 state implementation plan submittals. An overview of the SIP review process at the state level and the SIPS for particulate matter, sulfur dioxide and ozone. Final report.** Goklany, I.; Bhatia, V.; Blaszak, T. (Pacific Environmental Services, Inc., Elmhurst, IL (USA)). Dec 1980. 315p. NTIS, PC A14/MF A01.

This technical overview of the state implementation plan development process is based on the revised SIPs submitted in 1979 in response to the requirements of the 1977 Clean Air Act Amendments. Evaluates the adequacy of the emission inventory and ambient air monitoring, and meteorological data bases. Gathered information on SIP development processes for total suspended particulates, sulfur dioxide and photochemical oxidants.

28519 **(PB—81-154296) Institutional assessment of the implementation and enforcement of the Clean Air Act: Florida case study. Draft report.** Hudson, J.F.; Innes, R.C. (Urban Systems Research and Engineering, Inc., Cambridge, MA (USA)). 15 Oct 1980. 246p. NTIS, PC A11/MF A01.

This report examines and evaluates the capabilities and effectiveness of the institutions charged with enforcing the Clean Air Act requirements in the state of Florida. Among the sections of the Act addressed are those dealing with Federal grants (Sections 105 and 175), designation and planning (Sections 107 and 110), enforcement issues (Sections 113, 114 and 120), and citizen suits (Section 304). The Title I, Part D requirements for nonattainment areas are reviewed extensively. This evaluation is part of a larger effort to aid the National Commission on Air Quality in assessing the ability of various levels of government to develop, implement, and enforce air quality management strategies in response to the requirements of the Act. Case studies are also underway in Puget Sound, Washington; Houston, Texas; the Pittsburgh, Pennsylvania to Youngstown, Ohio area; and the Eastern Tennessee River Valley of Alabama and Tennessee. A summary report will integrate the findings of these five studies.

28520 **Regulating residential biomass combustion in the Tennessee Valley region.** Phillips, J.W.; Duncan, J.R.; Barnard, B.L. pp 1216-1228 of Residential solid fuels: environmental impacts and solutions. Cooper, J.A.; Malek, D. (eds.). Beaverton, OR; Oregon Graduate Center (1982).

From 1981 international conference on residential solid fuels; Portland, OR, USA (1 Jun 1981).

The resurgence of interest in biomass combustion as an alternative method of space heating has sparked concern among environmental regulatory agencies. In addition, many environmentalists are becoming alarmed over what they see as a possible return to smoke filled streets between rows of homes heated with the solid fuel fired stoves of the early 1900's. Even more alarming is that modern wood or coal burning stoves emit increased quantities of carbon monoxide, polycyclic organic material, and other long chain hydrocarbons. As improvements are made in stove design projected emissions may be mitigated. However, the implication is clear that with the escalation in price of energy, biomass for home heating becomes ever more attractive. The clear trend in the Tennessee Valley region is toward the increased installation of residential biomass combustion units. The actual impact of these units on ambient air quality in the region is, as yet, undetermined but was the subject of a 1981 winter field study the results of which are to be presented in another paper at this meeting. A regional model applied to determine the impact potential has predicted increases in total suspended particulate matter. It is the eventual determination of the magnitude of these source impacts that will shape the regulatory response. This paper outlines the history of regulations, and the likely framework of potential future regulations to limit emissions from residential biomass sources in the Tennessee Valley region.

28521 **Regulatory options for controlling emissions from combustion of wood in residential applications.** Mors, T.A.; Blair, T.T.; Cole, R.H. (Dalton-Dalton-Newport, Cleveland, OH). pp 1253-1271 of Residential solid fuels: environmental impacts and solutions. Cooper, J.A.; Malek, D. (eds.). Beaverton, OR; Oregon Graduate Center (1982).

From 1981 international conference on residential solid fuels; Portland, OR, USA (1 Jun 1981).

Investigations have indicated that wood combustion can result in the emission of particulate matter, hazardous substances, and carcinogenic compounds. With the increasing popularity of wood as a fuel for residential space heating, increasing air quality degradation can be expected. A number of existing federal and local laws and regulations covering these areas were examined in this research to determine the available options for controlling pollution from residential wood-burning stoves. Pollution control can be achieved through the regulation of fuel supply, indoor and ambient pollution emissions, and disposal of stove waste. Another approach would be to discourage stove installation or make use more expensive by taxation. Although wood fuel is the specific focus of this paper, much of the discussion is pertinent to residential coal stoves, which are also increasing in popularity. Each regulation reviewed has been evaluated for its effects on the wood-burning industry. The analysis covers the entire consumer-supplier complex, including stove manufacturer, stove distributor, wood supplier, wood burner, stove installer, and chimney cleaner. Potential problems have been identified in the application of each regulation. The majority of regulatory impacts appear to fall on the consumer, and such restrictions would probably be unpopular and enforcement difficult and costly. An alternative approach,using regulatory and fiscal incentives to encourage manufacturers to market less polluting stoves, appears to be a more effective pollution control method for new stoves. Retrofit pollution control devices are a possible option for existing stoves.

51 ENVIRONMENTAL SCIENCES, TERRESTRIAL

5101 Basic Studies

REFER ALSO TO CITATION(S) 28456, 28538, 28551

28522 (FWS/OBS—80/26, pp 94-102) **Ecosystem profile analysis and performance curves as tools for assessing environmental impact.** Odum, E.P.; Cooley, J.L. Jun 1980. NTIS, PC A11/MF A01.

From Symposium on biological evaluation of environmental impact; New Orleans, LA, USA (2 Jun 1976).

It is suggested that environmental impact assessment should evolve from the descriptive component approach toward a holistic approach which combines the use of broad ecosystem properties with specific local factors of public concern (red flags). The integration of economic and ecologic considerations is stressed. Two test cases are outlined. Graphic models are presented for comparative analysis.

28523 (FWS/OBS—80/26, pp 217-229) **National Biological Monitoring Inventory: A potential aid to planning environmental impact statements.** Kemp, H.T.; Burgess, R.L. Jun 1980. NTIS, PC A11/MF A01.

From Symposium on biological evaluation of environmental impact; New Orleans, LA, USA (2 Jun 1976).

The National Inventory of Selected Biological Monitoring Programs is described and presented as a source of information for those involved in planning and conducting environmental impact studies.

28524 **Population structure of forests over a large area.** West, D.C.; Shugart, H.H., Jr.; Ranney, J.W. (Oak Ridge National Lab., TN). *Forest Science;* 27: No. 4, 701-710(Dec 1981). Contract W-7405-ENG-26.

Forest structure was examined along a wide transect extending from Oklahoma to North Carolina and covering a wide variety of forest types and species. A composite curve produced by all the species included in the sample showed an overall concave form of the semilogarithmic density-diameter curve, with a rotated sigmoid shape at the mid-diameter size-class range. The degree to which individual species exhibited the concave or convex shape was directly related to shade-tolerance capacities of species. Stratification of regional forest stands by diameter class (age) showed the rotated sigmoid shape to exist at the all-species level and for some individual species within the oldest stands. In eastern deciduous forests, rotated sigmoid density-diameter distributions will occur on a regional basis in response to canopy-understory interactions as stand average diameter increases and as the relative importance of shade-tolerant tree species increases. Sigmoid density-diameter distributions in contrast to linear or slightly concave/convex distributions do not necessarily indicate a deviation from the structural development patterns of undisturbed forest stands. However, effects from forest harvesting on regional forest structure cannot be totally discounted as a source of structural variation from a negative exponential pattern.

5102 Chemicals Monitoring And Transport

REFER ALSO TO CITATION(S) 28485, 28975

28525 (PB—82-110545) Landfill gas and leachate monitoring: Helena, Montana - a technical assistance panels program report. Final report. Baker, R.; Jewett, M.; Jubenville, D.; Kuntz, D.; Lokey, B. (Hart (Fred C.) Associates, Inc., Denver, CO (USA)). Jul 1981. 63p. NTIS, PC A04/MF A01.

Leachate contamination of ground water and methane gas production are potential problems associated with solid wastes deposited in landfills. Expanding urban areas may utilize former sites for residential building sites, schools, and parks. This report presents an example of a method which can be used to design a permanent methane gas and leachate monitoring program from a relatively inexpensive preliminary investigation. The monitoring program was conducted on a landfill located within the city limits of Helena, Montana in 1980. A barhole punch survey was conducted to delineate areas of methane gas concentrations and to guide placement of wells. Seven monitoring wells were drilled, logged, and samples were collected. An MSA Model 53 Gascope was used to measure the percent of volume of gas in air and the lower explosive limit of the gas. Water samples were analyzed in a laboratory under selected parameters. Preliminary findings indicated that only a moderate amount of methane gas is being generated and migration of the gas appeared to be minimal. Leachate from the landfill did not appear to have contaminated the ground water. The report recommends that a long term water quality and methane gas monitoring program be instituted and estimates costs of such a program.

5103 Radioactive Materials Monitoring And Transport

REFER ALSO TO CITATION(S) 27743, 28174, 28180, 28181, 28184, 28433, 28434, 28435, 28439, 28535

28526 (CONF-811103—54) Alpha-beta-gamma spectrometer as an aid in directing decontamination of soils. Berger, C.D. (Oak Ridge National Lab., TN (USA)). 1981. Contract W-7405-ENG-26. 7p. NTIS, PC A02/MF A01. Order Number DE82004122.

From ANS winter meeting; San Francisco, CA, USA (29 Nov 1981).

This technique permits rapid assessment of alpha-beta-gamma-emitter contamination in soils at sufficiently low concentrations to direct field operations. Of particular importance is its applicability during initial decommissioning and decontamination surveys when characterization of alpha and beta contamination in the presence of a high gamma background is necessary. This system has not yet been made portable for in-situ use, but it is expected that results willbe favorable when operated as a field instrument, resulting in simplified standard decontamination operation.

28527 (LA—9070-PR) Environmental and radiological safety studies. Interaction of $^{238}PuO_2$ heat sources with terrestrial and aquatic environments. Progress report, July 1-September 25, 1981. Matlack, G.M.; Patterson, J.H. (Los Alamos National Lab., NM (USA)). Nov 1981. Contract W-7405-ENG-36. 6p. NTIS, PC A02/MF A01. Order Number DE82004681.

Although existing radioisotope thermoelectric generator designs have proved more than adequately safe, more information is continually sought about the heat sources to improve their safety. The work here includes studies of the effects on the heat sources of terrestrial and aquatic environments and also of the effects of the heat sources on various simulated environments. This progress report presents recent data from environmental chamber and aquatic experiments and gives the present status of the experiments.

28528 (LBL—12100, pp 70) Sorptive diffusion in clay gels. Radke, C.J. Jul 1981. NTIS, PC A12/MF A01. Order Number DE82000804.

In Earth Sciences Division annual report 1980.

The purpose of this project is to devise and verify experimentally a quantitative model for the diffusion of ions in aqueous smectite gels under conditions appropriate for nuclear waste isolation. Work this year centered on simple experiments for diffusion of cesium into a bentonite (Belle Fourche) clay gel. The cesium uptake rate into the clay is monitored from concentration changes in a well-stirred tank. Atomic absorption spectrophotometry is used to determine the transient ion concentrations. In addition to the one-sided diffusion cell measurements, the cesium-sodium ion-exchange isotherm for the disaggregated clay is determined by the static method; the bulk-diffusion coefficient of cesium chloride, D, is determined with a standard diaphragm cell; and the tortuosity, tau, of the gel is determined from electrical conductivity experiments.

28529 (PNL—4100-Pt.2, pp 157) Review of soil contamination guidance. Soldat, J.K.; Mueller, M.A.; Kennedy, W.E. Jr. Feb 1982. NTIS, PC A08/MF A01.

In Annual Report for 1981 to the DOE Office of the Assistant Secretary for Environmental Protection, Safety, and Emergency Preparedness. Part 2. Ecological Sciences.

A review of existing and proposed radioactive soil contamination standards and guidance was conducted for United Nuclear Corporation (UNC), Office of Surplus Facilities Management. The more applicable standards were reviewed, evaluated and summarized. Information pertaining to soil contamination for both facility operation and facility decommissioning was obtained from a variety of sources. Most of the information reviewed was consistent with the philosophy of maintaining exposures at levels as low as reasonably achievable (ALARA).

28530 (SCPRI-RM—3-1981) Monthly results of measurements. March 1981. (Service Central de Protection contre les Rayonnements Ionisants, 78 - Le Vesinet (France)). 1981. 45p. (In French). NTIS (US Sales Only), PC A03/MF A01. Order Number DE81700683.

Measurement tables concerning the surveillance of the environment in France (see also the SCPRI-RT--1-1981 report).

28531 (SCPRI-RM—12-1980) Monthly results of measurements. December 1980. (Service Central de Protection contre les Rayonnements Ionisants, 78 - Le Vesinet (France)). 1980. 42p. (In French). NTIS (US Sales Only), PC A03/MF A01. Order Number DE81700682.

Measurement tables concerning the surveillance of the environment in France (see also the SCPRI-RT--4-1980 report).

28532 (SCPRI-RT—1-1981) 1. Quaterly progress report, 1981. (Service Central de Protection contre les Rayonnements Ionisants, 78 - Le Vesinet (France)). 1981. 30p. (In French). NTIS (US Sales Only), PC A03/MF A01. Order Number DE81700684.

This quarterly report of the SCPRI exposes an interpretation of the principal results concerning the surveillance of radioactivity in the environment: atmospheric dusts, rainwater, surface water, un-

derground water, irrigation water, drinking water, food chain, sea water around nuclear plant sites and other sites. The activities of various radioisotopes are presented in tables (^{7}Be, ^{95}Zr and ^{95}Nb, ^{103}Ru, ^{131}I, ^{137}Cs, ^{140}Ba and ^{140}La, ^{90}Sr, ^{106}Ru and ^{106}Rh, ^{226}Ra, ^{54}Mn, U and T). A bibliographic selection is also presented.

28533 (SCPRI-RT—4-1980) 4. Quarterly progress report, 1980. (Service Central de Protection contre les Rayonnements Ionisants, 78 - Le Vesinet (France)). 1980. 31p. (In French). NTIS (US Sales Only), PC A03/MF A01. Order Number DE81700685.

This quarterly report of the SCPRI exposes an interpretation of the principal results concerning the surveillance of radioactivity in the environment: atmosheric dusts, rainwater, surface water, underground water, irrigation water, drinking water, food chain, sea water around nuclear plant sites and other sites. The activities of various radioisotopes are presented in tables (^{7}Be, ^{95}Zr and ^{95}Nb, ^{103}Ru, ^{131}I, ^{137}I, ^{137}Cs, ^{140}Ba and ^{140}La, ^{90}Sr, ^{106}Ru and ^{106}Rh, ^{226}Ra, ^{54}Mn, U and T). A bibliographic selection is also presented.

28534 Precipitation of radiostrontium in soil. Spalding, B.P. (Oak Ridge National Lab., TN). pp 243-250 of Scientific basis for nuclear waste management. Volume 3. Moore, J.G. (ed.). New York, NY; Plenum Publishing Corporation (1981). Contract W-7405-ENG-26.

It is the purpose of the present study to learn whether precipitated Ca-Sr phases can be formed in soil competition with such changes in exchange selectivity and capacity. Candidate insoluble Ca-Sr phases include the carbonate, oxalate, fluoride, phosphate, aluminate, and silicate. More important than the formation of these phases in soil is the knowledge of how isotopically/isomorphically exchangeable any precipitated activity would be with dissolved Ca in a leaching groundwater. These questions were addressed experimentally by treating soils with a fixed quantity of the particular precipitating anion solution and, subsequently, spiking this mixture with an increment of $CaCl_2$ containing either ^{45}Ca, ^{85}Sr, or ^{22}Na and observing the radioisotopic distribution. Two additional increments of $CaCl_2$ were sequentially added and the redistributions of radioisotopes observed. Such a batch equilibrium method was designed to simulate a chemically-modified soil coming into contact with a radiostrontium contaminated groundwater and the subsequent leaching of any nascent precipitated phase by additional groundwater.

5105 Site Resource And Use Studies

REFER ALSO TO CITATION(S) 27647

28535 (DOE/EV/02307—17) Biological/environmental relationships in desert ecosystems of the Nevada Test Site. Final report, February 1, 1973-August 31, 1980. Beatley, J.C. (Cincinnati Univ., OH (USA). Dept. of Biological Sciences). Nov 1981. Contract AS02-76EV02307. 5p. NTIS, PC A02/MF A01. Order Number DE82003652.

Contract has involved the processing and bringing to publiction form data collected on the Gen-12 contract 1960 to 1973. The nature and objectives of that field program, conducted at the Nevada Test Site, have been elaborated elsewhere through the years. Publications of the contract period February 1, 1973 to August 31, 1980 are listed, and status of the research and research records is recorded at this time of dissolution of the 20-year research association of the investigator with the Atomic Energy Commission and its agency successors.

5106 Regulations

REFER ALSO TO CITATION(S) 28066

52 ENVIRONMENTAL SCIENCES,

AQUATIC

5201 Basic Studies

REFER ALSO TO CITATION(S) 28456, 28522, 28523, 28551

28536 (FWS/OBS—80/26, pp 230-237) Application of diversity indices in marine pollution investigations. Swartz, R.C. Jun 1980. NTIS, PC A11/MF A01.

From Symposium on biological evaluation of environmental impact; New Orleans, LA, USA (2 Jun 1976).

The concepts of diversity which are most pertinent to pollution research are explored, as well as indices through which they can be quantified. Examples of diversity alterations in macrofounal benthic assemblages exposed to various forms of stress.

28537 (PB—82-109083) Green River Basin comprehensive coordinated joint plan. (Ohio River Basin Commission, Cincinnati (USA); Water Resources Council, Washington, DC (USA)). 22 Apr 1977. 157p. NTIS, PC A08/MF A01.

The report is on a regional water resources management plan for the Green River Basin in Kentucky and Tennessee.

28538 (PNL—4100-Pt.2, pp 149-150) Service assessment studies. Watson, D.G.; Rickard, W.H.; Fitzner, R.E. Feb 1982. NTIS, PC A08/MF A01.

In Annual Report for 1981 to the DOE Office of the Assistant Secretary for Environmental Protection, Safety, and Emergency Preparedness. Part 2. Ecological Sciences.

Service Assessment Studies are supported through the DOE Richland Operations Office and are concerned with the long-term ecological monitoring of animal populations that may be affected by operations of the Hanford site. They provide data useful for the natural resource management of the middle Columbia River as well as for the estimation of the effects of operations at Hanford.

28539 Primary productivity in the sea. Falkowski, P.G. New York, NY; Plenum Press (1980). 531p. Plenum Press, New York $49.50.

Recent progress in primary productivity is discussed in the book based on 27 symposia texts and 19 poster abstracts. Most papers deal with particular cellular processes in pelagic phytoplankton and their relationship to whole plant photosynthesis and growth. In addition, presentations on the productivity of the seaweed, Laminaria, zooxanthellae and whole corals are included. Other articles discuss predictive modeling, new developments in remote sensing, nutrient regeneration within the sea, grazing effects, and carbon cycling. (JMT)

5202 Chemicals Monitoring And Transport

REFER ALSO TO CITATION(S) 27710, 27712, 27713, 28536, 28537, 28698, 28704, 28716, 28975

28540 (CONF-8110104—1) Fate of trace metals in the sediments of the New York Bight. Krom, M.D.; Turekian, K.K.; Cutshall, N.H. (Oak Ridge National Lab., TN (USA); Wesleyan Univ., Middletown, CT (USA). Dept. of Earth and Environmental Sciences; Yale Univ., New Haven, CT (USA). Dept. of Geology and Geophysics). 1981. Contract W-7405-ENG-26. 8p. NTIS, PC A02/MF A01. Order Number DE82002873.

From 3. international ocean dumping symposium; Woods Hole, MA, USA (12 Oct 1981).

The study was undertaken to assemble in one report all the available information on trace metal concentrations in the sediments of the New York Bight (NYB) in order to help understand the fate of those trace metals in that environment. This area is a major repository for the waste products from the New York City conurbation. Interest was focused on those trace metals which are major contaminants, viz, Zn, Cu, Pb, Cr, and Ni, and especially those elements considered the greatest direct toxic threat to humans via the marine food chain, Cd and Hg. The raw data assembled included

more than 8000 determinations of 16 elements from 1000 stations in the NYB. Where available, additional, relevant data such as grain size, total organic carbon (TOC) and loss on ignition (LOI) were also assembled. These data together with correlation matrices and maps derived from the data have been assembled in a separate report (Korm, in prep.). This report presents the scientific conclusions derived from a consideration of those data.

28541 (FWS/OBS—80/26, pp 73-83) **Risk analysis for aquatic ecosystems.** Cairns, J. Jr.; Dickson, K.L. Jun 1980. NTIS, PC A11/MF A01.

From Symposium on biological evaluation of environmental impact; New Orleans, LA, USA (2 Jun 1976).

A methodology for estimating ecosystem vulnerability is discussed. Risk analysis should include both the vulnerability to ecosystem displacement in structure and function and the probability of returning to an approximation of the original condition if displacement occurs. The use of biological monitoring systems is discussed.

28542 (FWS/OBS—80/26, pp 170-180) **Evaluating the significance of degradation in a large ecosystem.** O'Connor, J.S. Jun 1980. NTIS, PC A11/MF A01.

From Symposium on biological evaluation of environmental impact; New Orleans, LA, USA (2 Jun 1976).

The effects of ocean waste disposal practices in the New York Bight are assessed. Scientific findings, particularly in the years 1973-1976, are reviewed. It is found that the Bight is one of the most degraded coastal ecosystems in the U.S., but that sewage sludge dumping is a small contributor of contaminants.

28543 (PB—82-124975) **Environmental assessment of the Alaskan Continental Shelf. Final reports of principal investigators. Volume 10. Biological studies.** (National Oceanic and Atmospheric Administration, Boulder, CO (USA). Office of Marine Pollution Assessment). Jul 1981. 790p. NTIS, PC A99/MF A01.

This volume of final reports includes the following: Forage Fish Spawning Surveys Southern Bering Sea; Effects of Oil Contamination in the Sea Otter; Reconnaissance of Intertidal Communities in the Eastern Bering Sea; Effects of Ice Scour on Community Structure; and Study of Microbial Activity and Crude Oil-Microbial Interactions in the Waters and Sediments of Cook Inlet and the Beaufort Sea.

28544 (PB—82-124983) **Environmental assessment of the Alaskan Continental Shelf. Final reports of principal investigators. Volume 11. Biological studies.** (National Oceanic and Atmospheric Administration, Boulder, CO (USA). Office of Marine Pollution Assessment). Jul 1981. 675p. NTIS, PC A99/MF A01.

This volume of final reports includes the following: Toxicity of Oil-Well Drilling Muds to Alaska Larval Shrimp and Crabs; Trophic Relationships Among Ice-Inhabiting Phocid Seals and Functionally Related Marine Mammals in the Chukchi Sea; Trophic Relationships Among Ice-Inhabiting Phocid Seals and Functionally Related Marine Mammals in the Bering Sea; Ecological Studies in the Bering Strait Region; and The Relationships of Marine Mammal Distributions, Densities and Activities to Sea Ice Conditions.

5203 Radioactive Materials Monitoring And Transport

REFER ALSO TO CITATION(S) 28174, 28175, 28179, 28179, 28181, 28183, 28184, 28187, 28188, 28433, 28436, 28439, 28527, 28530, 28531, 28532, 28533

28545 (DOE/EV/71001—13) **Studies on the concentrations of ^{55}Fe in South Pacific Ocean water and marine organisms and in the Columbia River. Final report, July 1, 1977-September 30, 1979.** Jennings, C.D. (Western Oregon State Coll., Monmouth (USA)). 1979. Contract AT06-76EV71001. 17p. NTIS, PC A02/MF A01. Order Number DE82004480.

Results of research on processes controlling the distribution of ^{55}Fe in the Columbia River ecosystem and the Pacific Ocean are reported. Direct measurements of ^{55}Fe in seawater and in zooplankton indicate that marine organisms concentrate ^{55}Fe in preference to stable iron. In measurements of ^{55}Fe in marine organisms from various depths it was determined that the highest concentrations are found in the mesopelagic and epipelagic zones in fishes and crustaceans. Only low concentrations were noted in fishes and sea cucumbers from the sea floor. (JGB)

28546 **Migration of ruthenium-106 in a Nevada Test Site aquifer: discrepancy between field and laboratory results.** Coles, D.G.; Ramspott, L.D. (Lawrence Livermore National Lab., CA). *Science (Washington, D.C.);* **215**: 1235-1237(5 Mar 1982). Contract W-7405-ENG-48.

Ruthenium-106 has been observed to migrate in ground water at about the same velocity as tritium from the site of an underground nuclear explosion to a pumped satellite well 91 meters distant. This finding contradicts the prediction, based on laboratory batch sorption measurements, that ruthenium-106 should migrate at a much lower rate than tritium. To predict migration of radionuclides in ground water, more relevant laboratory measurements are required.

5204 Thermal Effluents Monitoring And Transport

REFER ALSO TO CITATION(S) 28694

28547 (PB—81-147019) **Abundance, distribution and use of power plant effluents by manatees (Trichechus manatus) in Brevard county, Florida. Final report, Jan 1978-Feb 1980.** Shane, S.H. (National Fish and Wildlife Lab., Gainesville, FL (USA)). 1 Jan 1981. 250p. NTIS, PC A11/MF A01.

Brevard County, on Florida's east coast, contains one of the largest concentrations of manatees remaining in Florida. This population was studied from January 1978 through February 1980 using aerial surveys, and boat and land observations. As many as 250 manatees were counted in the county in the spring of 1979. During the warm months most manatees were observed in the Banana River, but during the winter most manatees (up to 100) were found in the warm effluent zones of two power plants on the Indian River. Declining air and water temperatures were significantly correlated with increases in the number of manatees in the power plant effluents. Manatees rely heavily upon these power plants as winter refuges, and plant shut-downs could prove disastrous for these animals.

5205 Site Resource And Use Studies

REFER ALSO TO CITATION(S) 27665, 27709

53 ENVIRONMENTAL-SOCIAL ASPECTS OF ENERGY TECHNOLOGIES

5301 Social And Economic Studies

REFER ALSO TO CITATION(S) 27711, 28071, 28537, 28673

28548 (LBL—13408) **Impact of the 1980 BEIR-III report on low-level radiation risk assessment, radiation protection guides, and public health policy.** Fabrikant, J.I. (Lawrence Berkeley Lab., CA (USA); California Univ., San Francisco (USA). School of Medicine). Jun 1981. Contract W-7405-ENG-48. 31p. (CONF-8106181—1). NTIS, PC A03/MF A01. Order Number DE82003046.

From Health physics summer school on selected topics in reactor health physics; Lexington, KY, USA (14 Jun 1981).

The author deals with the scientific basis for establishing appropriate radiation protection guides, and this effect on evaluation of societal activities concerned with the health effects in human populations exposed to low-level radiation. Methodology is discussed for estimating risks of radio-induced cancer and genetically related ill-health in man, the sources of data, the dose-response models used, and the precision ascribed to the process. (PSB)

28549 **(PB—82-109869) A model of migration in the Ohio River Basin Energy Study region.** Gordon, S.I.; Badger, C. (Ohio River Basin Energy Study, Urbana, IL (USA)). Sep 1981. 59p. NTIS, PC A04/MF A01.

The report was prepared as part of the Ohio River Basin Energy Study (ORBES), a multidisciplinary policy research program. It examines the impact of regional energy development scenarios and policies on the internal movements of population and industry within the project study region, which covers all of Kentucky, most of West Virginia, and substantial portions of Illinois, Indiana, Ohio, and Pennsylvania. For any particular economic and population forecast, some level of regional growth is implied. The location of this growth within the region may be influenced by, or may induce, the location and movement of population within the region. No national-level projections were generated that would allow the generation and use of a model to predict such migration. Thus, this report covers the attempt to develop such a regional model. First, other attempts to derive empirical models of migration that relate to the theory behind the model developed here are reviewed. Data sources are described in terms of geography, time, and variable type. The models derived are then described, and the pros and cons of using each for simulating ORBES regional impacts are discussed. and solutions.

28550 **Health costs of residential wood combustion.** Jacobs, P. (Univ. of South Carolina, Columbia); Bunch, S. pp 657-669 of Residential solid fuels: environmental impacts and solutions. Cooper, J.A.; Malek, D. (eds.). Beaverton, OR; Oregon Graduate Center (1982).

From 1981 international conference on residential solid fuels; Portland, OR, USA (1 Jun 1981).

The purpose of this paper is to develop an analytical form for measuring the economic impact of mortality caused by pollution from residential wood burning, and to apply the analysis to obtain preliminary estimates of these health costs. In the analytical model relationships are posited between wood use, emissions, ambient air quality changes, mortality and health costs. Using available data for four cities, estimates are made of the mortality impact of residential wood burning created pollution, and of the economic magnitude of this mortality in terms of added cost per pound of wood used as well as of overall economic costs. The estimates show that residential wood burning sources contribute 3/10 of one percent of all deaths; they add about five percent to the private cost of wood burning; and contributes between $18 and $41 million in total health costs annually.

28551 **Umweltbiologie. Oekologie und Umweltkrise. (Environmental biology. Ecology and environmental crisis).** Tschumi, P.A. Frankfurt am Main, Germany, F.R.; Diesterweg (1981). 278p.

Environmental biology illustrates the functioning of ecosystems and the dynamics of populations with many examples from limnology and terrestrial ecology. On this basis, present environmental problems are analyzed. The present environmental crisis is seen as a result of the failure to observe ecological laws.

5302 Assessment Of Energy Technologies

REFER ALSO TO CITATION(S) 27742, 28457, 28537, 28549

28552 (PNL—4100-Pt.2, pp 151) **Power plant fuel conversion environmental impact assessment.** Watson, D.G. Feb 1982. NTIS, PC A08/MF A01.

In Annual Report for 1981 to the DOE Office of the Assistant Secretary for Environmental Protection, Safety, and Emergency Preparedness. Part 2. Ecological Sciences.

During FY 1981, Ecological Sciences Department staff participated in a Pacific Northwest Laboratory interdepartmental program to assist the DOE Economic Regulatory Administration prepare environmental impact assessments of the conversion of oil-burning electrical generating stations to coal or other alternate fuels. Draft environmental reports were prepared for the fuel conversion of four generating stations operated by the Baltimore Gas and Electric Company near Baltimore, Maryland, and for one generating station located near Sayreville, New Jersey, operated by Jersey Central Power and Light Company.

28553 (PNL—4100-Pt.2, pp 169) **Energy-related research for other agencies.** Feb 1982. NTIS, PC A08/MF A01.

In Annual Report for 1981 to the DOE Office of the Assistant Secretary for Environmental Protection, Safety, and Emergency Preparedness. Part 2. Ecological Sciences.

The purpose of this section is to identify energy research tasks conducted for other sponsors cooperating with DOE. In these cases, interagency and other mutual agreements have been executed to support work on a nonduplicative basis. Research topics identified in this section are complementary to work discussed in other sections of this report, and the data bases being developed provide a unique long-term reference for environmental and energy assessment in arid western locations.

28554 **Development of workplace guidelines for emerging energy technologies.** White, O. Jr. (Brookhaven National Lab., Upton, NY); Lillian, D. *ACS (American Chemical Society) Symposium Series;* **34**: No. 149, 543-550(1981).

The Center for Assessment of Chemical and Physical Hazards (CACPH) has been established to facilitate timely development of interim exposure guidelines for chemical and physical occupational and environmental hazards which are uniquely associated with activities of the Department of Energy. CACPH has been staffed and equipped to respond to the changing and demanding needs often associated with emerging energy technologies such as coal conversion, oil shale, solar (photovoltaic), geothermal and wind. These guidelines are essential to health and safety professionals responsible for assessment and control of workplace hazards. A system has been developed which utilizes the expertise and experience of reputable scientists to ensure that the guidelines generated represent sound science. Additionally, a pool of consultants from industry, labor, academia, and government has been established to provide independent review.

5303 Environmental Impact Statements

REFER ALSO TO CITATION(S) 27709

55 BIOMEDICAL SCIENCES, BASIC STUDIES

5502 Biochemistry

REFER ALSO TO CITATION(S) 28197, 28563, 28671, 28719, 28731

28555 **(DOE/EV/04330—T1) Synthesis of new fluorescent DNA binding agents.** (Pennsylvania Univ., Philadelphia (USA)). Oct 1981. Contract AS02-77EV04330. 17p. NTIS, PC A02/MF A01. Order Number DE82004392.

The syntheses of new ferrocenyl containing acridines, and polyamine containing 2-phenyl indole derivatives have been propoed for this period. The use of these new fluorescent DNA binding agents will provide means to study the distribution of DNA base ratio, and the ultrastructural study of chromosome structure. Correlation of light and electronmicroscopic observation with these new probes will be carried out in the course of this investigation. The syntheses of polyaza-E-A and poly U block polymers by RNA ligase will be continued. Such copolymers will be tested for the localization of RNA by the hybridization technique. Initially we will continue to test the m-RNA localization by these copolymers based on the hybridization with poly-A track of the processing m-RNA. Fluorescent polarization study will be used to ascertain the optimal probe length for m-RNA.

28556 **(PB—81-803959) Radioimmunoassay studies. 1964-February 1981 (citations from the NTIS Data Base). Report for 1964-Feb 1981.** (National Technical Information Service, Springfield, VA (USA)). Feb 1981. 253p. NTIS PC N01/MF N01.

The bibliography presents a compilation of references on the application of the radioimmunoassay test in biochemistry, clinical chemistry, immunology, microbiology, and pharmacology. (This updated bibliography contains 246 citations, 91 of which are new entries to the previous edition.)

28557 **In vivo studies of a synthetic inhibitor of thrombin.** Collen, D. (Univ. of Leuren, Belgium); Matsuo, O.; Stassen, J.M.; Kettner, C.; Shaw, E. *Journal of Laboratory and Clinical Medicine;* **99**: No. 1, 76-83(Jan 1982).

The kinetics and the turnover and anticoagulant action in rabbits were studied of D-phenylalanyl-L-prolyl-L-arginyl-chloromethyl ketone (D-Phe-Pro-Arg-CH_2Cl) (FPRMeCl), a synthetic irreversible inhibitor of thrombin. The inhibition of thrombin by FPRMeCl could be described as a two-step reaction; a reversible complex formation with a K\sub j\ of 3.7 x 10^{-8}M followed by formation of an irreversible complex with a rate constant k_2 of 0.4 sec^{-1}. The disappearance rate from the plasma in six rabbits after intravenous injection of 1 mg of FPRMeCl could be described by a sum of two exponential terms, the first with a half-life of 0.7 min and the second with a half-life of 2.9 min. The recovery of inhibitory activity in the urine in two rabbits was 2.3% and 5.4%. After subcutaneous injection of 1 mg in six rabbits, the FPRMeCl level in plasma rose to an average value of 1 μM after 10 min and decreased gradually to 50 nM after 90 min. Intravenous injection of 0.5 mg human thrombin over 5 min in seven anesthesized rabbits resulted in death due to massive thrombosis in the right heart. Six rabbits that had received an intravenous injection of 1 mg of FPRMeCl just before the thrombin infusion all survived without a significant drop in fibrinogen levels. Infusion of 12 ml of a brain thromboplastin suspension over 30 min in six rabbits resulted in extensive prothrombin activation (residual prothrombin 21% +/- 1.5 of preinfusion value) and virtually complete defibrination (residual fibrinogen 14% +/- 4). Subcutaneous injection of 1 mg of FPRMeCl before and 30 to 60 min after the start of the thromboplastin infusion in four rabbits resulted in a comparable degree of prothrombin activation and a decrease of the fibrinogen level to 30% +/- 5 of its preinfusion level.

28558 **Intracellular glycosylation of vitellogenin in the liver of estrogen-stimulated Xenopus laevis.** Gottlieb, T.A. (University of Tennessee-Oak Ridge Graduate School of Biomedical Sciences); Wallace, R.A. *Journal of Biological Chd Clinical Medicine;* **257**: No. 1, 95-103(Jan 1982). Contract W-7405-ENG-26.

Pulse-chase experiments measuring the rates of incorporation of radiolabeled glucosamine and galactose into intracellular vitellogenin show that glycosylation of this multicomponent protein occurs in a Golgi-enriched fraction isolated from homogenized liver slices. No apparent role of the rough endoplasmic reticulum in this process was demonstrable. Kinetics of the intracellular translocation of glycosylated vitellogenin indicate that the galactosylated intermediate is secreted more rapidly than the glucosamine-labeled precursor. This was corroborated by measuring the rates of accumulation of various pulse-labeled forms of vitellogenin in the chase medium. In addition, a negligible amount of mannose was incorporated into intracellular or secreted vitellogenin. The antibiotic tunicamycin was shown to inhibit [^{3}H] glucosamine incorporation into microsomal vitellogenin by 70% without any significant effect on the synthesis of the protein backbone. In addition, nonglycosylated vitellogenin showed normal secretion kinetics. After suitable pretreatment with the antibiotic followed by a labelling period in tunicamycin-free medium, mannose was still not incorporated into vitellogenin, whereas glucosamine behaved in a typical manner. In contrast to this finding, gas-liquid chromatography of the alditol acetate derivatives of the neutral hexoses of vitellogenin showed that mannose was indeed a major component of the vitellogenin oligosaccharide side chain. These preliminary results indicate that the oligosaccharide component of vitellogenin in Xenopus laevis is a "complex" type of carbohydrate unit which is linked via an N-glycosidic bond between an asparagine residue and N-acetylglucosamine. With respect to the subcellular localization of glycoprotein assembly in Xenopus liver, there is a significant departure from currently accepted models of glycoprotein synthesis.

28559 **Membrane transfer of α-tocopherol: influence of soluble α-tocopherol-binding factors from the liver, lung, heart and brain of the rat.** Murphy, D.J.; Mavis, R.D. (Univ. of Rochester, NY). *Journal of Biological Chd Clinical Medicine;* **256**: No. 20, 10464-10468(25 Oct 1981). Contract AC02-76EV03490.

The pH of liver supernatant was lowered from 7.4 to 5.1, which removed 23% of the soluble protein and 97% of the lipid-soluble phosphate, increased the total α-tocopherol transfer activity 1.3-fold and the specific activity of the transfer rate 1.6-fold. This transfer activity was proportional to time up to 4 min and to protein concentrations up to 0.1 mg/ml. Fractionation of the pH 5.1-treated liver supernatant by gel filtration produced a single peak of α-tocopherol transfer activity of M/sub r/ = 34,000 and a single peak of α-tocopherol-binding activity which was coincident with the transfer activity. The transfer rate of this peak of activity was 316 pmol/min/mg of protein, a 9-fold purification over the original untreated supernatant. This α-tocopherol transfer rate was reduced by 83 and 96% following pronase digestion or heat treatment (80°C) of the soluble fraction, respectively, while trypsin digestion reduced the transfer rate only 18% and phospholipase C digestion had no effect. Untreated liver supernatant possessed the peak of binding activity of M/sub r/ = 34,000 and a high molecular weight binding fraction that eluted at the void volume. Heart and brain supernatants also possessed an α-tocopherol-binding fraction that eluted at the void volume, while lung supernatant lacked binding activity.

28560 **Intestinal absorption of sugar.** Kimmich, G.A. pp 1035-1061 of Physiology of the gastrointestinal tract. Johnson, L.R. (ed.). New York, NY; Raven Press (1981).

Since 1973, two concepts have been established that widen our understanding of ion gradient coupled transport systems in general, and of Na^+-dependent epithelial sugar transport in particular. The first is recognition that membrane electrical potentials play a significant role in the bioenergetics and hence the molecular mechanism of ion coupled transport systems. Second, details of serosally localized sugar transport systems have been established along with an understanding that the function of these systems can dramatically modify earlier conclusions relating to the energetics of brush-border localized Na^+-dependent events. It is chiefly information related to these two aspects that forms the basis of this review. A brief description of the various methods used to evaluate intestinal transport events is presented in order to provide a short overview of the strengths and limitations of each procedure.

28561 **Efficiency and fidelity of cell-free protein synthesis by transfer RNA from aged mice.** Foote, R.S.; Stulberg, M.P. (Oak Ridge National Lab., TN). *Mechanisms of Ageing and Development;* **13**: 93-104(1980). Contract W-7405-ENG-26.

Transfer RNAs (tRNAs) from heart, kidney, liver, and spleen of mature (10 to 12 months old) and aged (29 months old) C57BL/6 mice were tested for their ability to translate encephalomyocarditis viral RNA in a tRNA-dependent cell-free system derived from mouse ascites tumor cells. The rates of in vitro protein synthesis were compared as a function of tRNA concentration, and the fidelity of translation was examined by sodium dodecyl sulfate gel electrophoresis and isoelectric focusing of the viral polypeptides synthesized in vitro. No significant age-related differences in either the efficiency or fidelity of synthesis were discovered, indicating that alternations in tRNAs are probably not involved in the cellular aging of these tissues.

5503 Cytology

REFER ALSO TO CITATION(S) 28730, 28731

5504 Genetics

REFER ALSO TO CITATION(S) 28674, 28737, 28739, 28740

28562 Variation in frequency of transformation by plasmid YRp7 in Saccharomyces cerevisiae. Johnston, J.; Hilger, F.; Mortimer, R. (Univ. of California, Berkeley). *Gene;* **16**: 325-329(1981). Contract W-7405-ENG-48.

Hybrid plasmid YRp7 (Escherichia coli plasmid pBR322 carrying a 1.4-kb yeast fragment containing the TRP1 gene) transforms two related haploid yeast strains (trpl) to Trp^+ at frequencies per μg DNA varying by two orders of magnitude. The diploid cross of these two strains is transformed at a frequency less than that of the low-frequency parent, indicating that high-frequency transformation is inherited in a recessive fashion. Segregant strains of two tetrads of this cross showed intermediate levels of transformability, suggesting the polygenic inheritance of transformation frequency. Levels of variation are changed extensively when frequencies are expressed as transformants per regenerated spheroplast colony, although the inheritance of higher frequency remains clearly recessive. Storage of spheroplast-DNA preparations at 4°C increases the yield of transformants with some strains.

28563 Mutant affecting the crystal cells in Drosophila melanogaster. Rizki, T.M. (Univ. of Michigan, Ann Arbor); Rizki, R.M.; Grell, E.H. *Wilhelm Roux' Archives of Developmental Biology;* **188**: 91-99(1980). Contract W-7405-ENG-26.

Black cells (Bc, 2 to 80.6 +-) mutant larvae of Drosophila melanogaster have pigmented cells in the hemolymph and lymph glands. In this report we present evidence that these melanized cells are a mutant form of the crystal cells, a type of larval hemocyte with characteristic paracrystalline inclusions. Bc larvae lack crystal cells. Furthermore, the distribution pattern of black cells in Bc larvae parallels that of experimentally-blackened crystal cells in normal larvae (phenocopy). In Bc/Bc zygotes black cells appear during mid embryonic development but in Bc^+/Bc zygotes pigmented cells are not found until late in the first larval instar. Crystal cells are present in the heterozygous larvae until this time, and paracrystalline inclusions can be seen in some of the cells undergoing melanization in these larvae. The rate of phenol oxidase activity in Bc^+/Bc larval cell-free extracts is less than half that of Bc^+/Bc^+ extracts whereas enzyme activity is undetectable in Bc/Bc larvae. We propose that the Bc^+ gene product is required for maintaining the integrity of the paracrystalline inclusions; in Bc/Bc larvae either the product is absent or nonfunctional so an effective contact between substrate and enzyme results in melanization of the cells. Phenol oxidase itself is either destroyed or consumed in the melanization process accounting for the absence of enzyme activity in Bc/Bc larvae. These studies confirm that the crystal cells store phenolic substrates and are the source of the hemolymph phenol oxidase activity in the larva of D. melanogaster.

28564 Genetic engineering of osmoregulation: impact on productivity for food, chemicals and energy. Rains, D.W.; Valentine, R.C.; Hollaender, A. New York, NY; Plenum Press (1980). 381p. Plenum Press, New York $39.50.

The book, based on the symposium proceedings presents papers on osmoregulatory mechanisms in procaryotic microorganisms, eucaryotic microorganisms, and higher plants; mechanisms of drought and cold tolerance; and on applications of genetics for plant improvement. In addition, discussions by the participants on molecular biology of osmoregulation and osmoregulatory mechanisms in higher plants are recorded.

5505 Metabolism

REFER ALSO TO CITATION(S) 28666, 28667

28565 Nutrient translocation in the outer canopy and understory of an eastern deciduous forest. Luxmoore, R.J.; Grizzard, T.; Strand, R.H. (Oak Ridge National Lab., TN). *Forest Science;* **27**: No. 3, 505-518(Sep 1981). Contract W-7405-ENG-26.

The translocation of nutrients into and out of outer canopy leaves of ten eastern deciduous forest species was calculated from the temporal patterns of foliar nutrient pools sampled through a growing season. The calculations accounted for average chemical leaching effects due to rainfall. There were no significant differences in translocation rate between species within the evergreen, understory, or overstory-deciduous tree groups. Evergreen species had lower translocation rates than deciduous trees. Translocation rates into leaves of deciduous species showed a very rapid increase during spring; however, by late May, foliar phosphorus was being translocated at a slow rate back to stems. A similar trend was established for nitrogen by mid-June. An internal storage pool is suggested as the major source of foliar nitrogen during the spring flush since a simulation of nitrogen uptake from soil could only account for one-fourth of the quantity of nitrogen transported to leaves by the end of May. Simulation further showed that trace levels of soluble nitrogen (0.01 ppm) in soil were sufficient to supply a deciduous forest with an estimated nitrogen uptake of 100 kg N ha^{-1} $year^{-1}$.

5506 Medicine

REFER ALSO TO CITATION(S) 28674, 28692

28566 (PB—81-859167) Hodgkins disease and radiotherapy. January 1978-November 1980 (citations from the Information Retrieval, Ltd. Data Base). Report for Jan 1978-Nov 1980. (New England Research Application Center, Storrs, CT (USA)). Feb 1981. 87p. NTIS PC N01/MF N01.

This retrospective bibliography contains citations concerning radiation as a treatment of Hodgkins Disease. Radiotherapy is discussed in relationship to the disease stage and its location. The use of chemotherapy in conjunction with radiotherapy is also discussed. The side effects of radiotherapy are prominently mentioned. (Contains 76 citations, fully indexed and including a table of contents.)

28567 Diagnostic and therapeutic results of angiography of blunt abdominal trauma. Wenz, W.; Reinbold, W.D. *Radiologe;* **22**: No. 3, 117-121(Mar 1982). (In German).

Angiographic findings in blunt abdominal trauma are reviewed. 693 posttraumatic angiograms were performed at the University of Freiburg from 1972-1980. 24% of these patients suffered from blunt abdominal trauma. It could be shown that recently ultrasongraphy and computerized tomography have replaced angiography as screening method. Remaining indications for angiography are primary vascular lesions, uncertain findings of US- and/or C Texamination and documentation of hemorrhage with the possibility of therapeutic intervention.

28568 Blunt abdominal trauma. Halbfass, H.J.; Farthmann, E.H. *Radiologe;* **22**: No. 3, 99-105(Mar 1982). (In German).

Up to 1970 the number of patients suffering from blunt abdominal trauma showed a substantial increase. In more than 50% of all cases there are additional injuries. The most important factor influencing the prognosis of these patients is the early and correct indication for operation and the avoidance of unnecessary laparotomies. As a primary aim in diagnosis one should consider the recognition of an intraperitoneal bleeding without risk for the patient. Peritoneal lavage as an invasive method with low complication rates has proved good. First reports also show good results using the sonography of the abdomen. The recognition of the injured organ allows a carefully directed operation. Concerning the prognosis it is of minor importance. The diagnosis in patients with blunt abdominal trauma at the university clinic of Freiburg consists of: sonography, followed in positive cases by laparotomy or angiography and laparotomy. In cases with questionable results a lavage is done.

28569 Effect of combined misonidazole and accelerated neon ions on a human melanoma transplanted into nude mice. Guichard, M. (Institut de Radiobiologie Clinique, Villejuif, France); Tenforde, T.; Curtis, S.; Malaise, E.P. *Radiology;* **142**: No. 1, 219-223(Jan 1982).

The response to accelerated neon ions of human Nall melanomas growing in nude mice was measured by an in vitro colony-forming assay following in situ tumor irradiation in the midposition of a 10-cm extended-peak ionization region. Values of the relative

biological effectiveness (RBE) for peak neon ions compared with ^{60}Coγ radiation were 3.2 and 3.4, respectively, at the 1% and 10% survival levels. Following irradiation with peak neon ions, the repair of potentially lethal damage (PLD) was comparable to that observed after γ irradiation. When misonidazole (1 mg/g intraperitoneal dose) was administered in combination with extended-peak neon ions, the drug enhancement ratio (ER) at the 1% survival level was 1.5 if the tumors were removed and plated in vitro immediately following irradiation, and 1.9 if tumor excision and plating were delayed for ≧ 6 hours. Administration of misonidazole completely inhibited PLD repair following either γ irradiation or extended peak neon-ion irradiation.

28570 **X-ray investigations in intensive care units.** Pokieser, H. *Radiologe;* 21: No. 10, 449-454(Oct 1981). (In German).

From special care following surgery and from artefical respiration of polio patients the modern and very special intensive medical care has developed. At the same time the provisional bedside radiology was improved to one branch of clinical radiology with special organisation and methods of investigation. Importance and urgency of radiological information are requiring close cooperation of all medical branches. Functions of these different groups have to be defined. The movable X-ray apparatus of 20 kV output is necessary for every intensive care unit. Hard beam technique for lung X-rays, scattered radiation grids and adequate positioning of the patient are important to get the same high quality pictures than from the radiological department.

28571 **Hemorrhage of the lung of newborns and its differential diagnosis.** Ponhold, W. *Radiologe;* 21: No. 10, 455-458(Oct 1981). (In German).

Chest X-rays of 17 newborns suffering from hemorrhage of the lung were analysed with special respect to kind of shadow and translucency. Most significant findings were fine-grained, coarse-spotted, striated, and homogenous shadows, indicating the hemorrhage. Differentiation of hyaline membranes in most cases is easy, whereas difficulties are arising for differentiation of hemorrhage and interstitial edema in cardiac decompensation and especially in shunt-heart defects. Differentiation with respect to pneumonic infiltrations is not possible except in white lungs, although signs of emphysema are giving indirect indication to a pneumonic infiltration. Chest X-rays are very useful to find out shadows, to diffentiate other reasons of a respiratory distress syndrome, and for follow-up investigations.

28572 **X-ray diagnosis of pneumothorax in intensive care units.** Galanski, M.; Hartenauer, U.; Krumme, B. *Radiologe;* 21: No. 10, 459-462(Oct 1981). (In German).

Pneumothorax is the most severe manifestation of pulmonary barotrauma which occurs in mechanical ventilation. Diagnosis of pneumothorax in intensive care radiology is of particular difficulty. Chest radiographs in supine position show a variety of signs which may be helpful but are not conclusive. There are different techniques for verification of ventrally located pneumothorax. 45° tangential radiographs of the hemithorax in question are most conclusive for demonstration of extrapulmonary air located inside the pleural cavity. This 45° technique is easy to carry out without changing the patients position.

28573 **Displacements and complications of superior vena cava catheter.** Jantsch, H.; Lechner, G.; Mauritz, W.; Waneck, R. *Radiologe;* 21: No. 10, 463-469(Oct 1981). (In German).

During a 16-months prospective study the frequency of displacements and complications of superior vena cava catheter has been investigated. The study showed, that the right jugular catheter has the lowest frequency of complications, and should be of primary choice. Pneumothoraces are rare with jugular vena catheters (0,05%), more frequently with subclavian catheters. Setting of superior vena catheter displacement in large veins is quite common. More important are catheter displacements in small veins, which are more frequent with jugular than with subclavian vena catheter (vena thoracica interna, vena pericardiacophrenica). Adequate X-ray control (high KV technic, sufficient amount of contrast medium) is necessary to recognize these complications. Correction of displaced catheter should be done under fluoroscopy. Serious complications a.e. tension pneumothorax and haemathothorax are rare and should be treated surgically. In some cases non recognized extraversal catheterposition is followed by infusions into the pleural cavity or the mediastinum.

28574 **Intraosseous osteolytic lesions.** Adler, C.P.; Wenz, W. *Radiologe;* 21: No. 10, 470-479(Oct 1981). (In German).

Any pathological damage occurring in a bone will produce either an osteolytic or osteosclerotic lesion which can be seen in the macroscopic specimen as well as in the roentgenogram. Various bone lesions may lead to local destructions of the bone. An osteoma or osteoplastic osteosarcoma produces an osteosclerotic lesion showing a dense mass in the roentgenogram; a chondroblastoma or an osteoclastoma, on the other hand, induces an osteolytic focal lesion. This paper presents examples of different osteolytic lesions of the humerus. An osteolytic lesion seen in the roentgenogram may be either produced by an underlying non-ossifying fibroma of the bone, by fibrous dysplasia, osteomyelitis or Ewing's sarcoma. Differential diagnostic considerations based on the radiological picture include eosinophilic bone granuloma, juvenile or aneurysmal bone cyst, multiple myeloma or bone metastases. Serious differential diagnostic problems may be involved in case of osteolytic lesions occurring in the humerus. Cases of this type involving complications have been reported and include the presence of an teleangiectatic osteosarcoma as well as that of a hemangiosarcoma of the bone.

28575 **Osteonecrosis or spontaneous fractures following renal transplantation.** Andresen, J.; Nielsen, H.E. *Radiologe;* 21: No. 10, 480-484(Oct 1981). (In German).

31 renal transplant recipients with posttransplant development of osteonecrosis or spontaneous fractures were evaluated with regard to age, duration of dialysis before transplantation. Determination of metacarpal bone mass at the time of transplantation and registration of bone resorption and soft tissue calcification at the time of transplantation and at the time of onset of osteonecrosis and spontaneous fractures were made. Apart from the increased mean age in patients with spontaneous fractures no difference was seen between the groups. Osteonecrosis and spontaneous fractures occurred in areas of trabecular bone. It seems most likely that after renal transplantation the patients show bone complications of different localization.

28576 **Late haemodynamic response to metrizamide and ioxaglate in canine renal angiography.** Satokari, K.; Kivisaari, A.; Virtama, P. *Radiologe;* 21: No. 10, 488-490(Oct 1981).

The renal blood flow was examined in six dogs for 2 h after contrast agent injection into the renal artery using the dye dilution method. After injection of an ionic contrast agent (iodamide) there was an initial vasodilatation and later constriction, but the blood flow was back to normal after 10-15 min. Ioxaglate caused a similar initial response, but after a relatively large dose the blood flow remained below normal for 2 h. Metrizamide caused an immediate reduction in the blood flow, which remained constantly reduced for 2 h. A total cessation of the renal blood flow was seen in two cases.

28577 **New markings of central venous catheters, am improvement for localisation on X-ray pictures.** Neumann, H.; Kamphues, R. *Radiologe;* 21: No. 10, 493-495(Oct 1981). (In German).

Despite the inweave of an X-ray positive thread the tip of a venous catheter is not always clearly delineated in the roentgenogram. The use of a new type of marking is considered to be constructive. The tip and further clearly identifiable equidistant markings along the length of the catheter are suggested. These facilitate an exact localisation of the catheter either directly or indirectly, and thus necessary corrections can be undertaken easily and exactly. Catheter fractures, embolisation of such fragments and extravenous placement of the catheter are immediately discernible. Furthermore we assume the X-ray dosage can be reduced and contrast medium accidents can be avoided.

28578 **Studies on indirect lymphography of the rectum in man.** Hares, M.M.; Evans, N.; Winstone, N.E.; Burns, J.; Path, M.R.C. *Lymphology (Stuttgart);* **14**: No. 3, 91-94(Sep 1981).

The study has shown that although there is histological evidence of some uptake of the Lipiodol Ultra-fluid by the lymphatics draining the rectal submucosa in patients with low rectal carcinoma the amount so taken up is so small that no discernible lymph node architecture can be determined, and in such patients it is of no use radiologically. The next stage of the study is to use indirect lymphangiography of the rectum in patients with a high rectal carcinoma.

28579 **Indirect caudal lymphography using a new water-soluble contrast agent - animal experimental studies in pigs.** Apitzsch, D.E.; Kroll, H.U.; Zuehlke, H.V. *Lymphology (Stuttgart);* **14**: No. 3, 95-100(Sep 1981).

Animal experiments on caudal lymphography in pigs are presented, using a new water-soluble contrast medium which is renally excreted. Indirect cutaneous administration renders possible the radiological visualization of the entire lymphatic drainage system of the lower limb, the retro-peritoneal space and the thoracic duct. Visualization of the lymphatic system is rapid, homogeneous and can be repeated as often as desired. The quality of the lymphogram is as good as that obtained by the current methods in common use.

28580 **Iotasul, a water-soluble (non-oily) contrast medium for direct and indirect lymphography.** Wenzel-Hora, B.I.; Kalbas, B.; Siefert, H.M.; Arndt, J.O.; Schloesser, H.W.; Huth, F. *Lymphology (Stuttgart);* **14**: No. 3, 101-112(Sep 1981).

Radiological, light microscopic and electron microscopic findings after direct and indirect lymphography with lotasul, a new non-ionic water-soluble (not oily) contrast medium, are reported. The results of the studies in 18 dogs clearly show that the roentgenological demonstration of the lymph system following intralymphatic administration of lotasul in the dog is not inferior to that following the use of conventional oily con contrast medium passes quickly to the lymphatic system and the lymph nodes and is eliminated within 24 hours. The complications and tissue reactions known from oily contrast media are not observed following use of the new water-soluble contrast medium. Furthermore, studies of the fine structures show unequivocally that no morphologically detectable changes attributable to the contrast medium occur either in the region of the injection or in the lymph vessels, lymph nodes and organs such as kidney, liver, lung, spleen and myocardium. Preliminary studies indicate that the new contrast medium offers the possibility of indirect demonstration of lymph vessel regions and groups of lymph nodes (indirect lymphography) which have largely escaped detection by the previous routine lymphographic examination.

28581 **Pre-operative staging of bronchial carcinomas.** Mueller, H.A.; van Kaick, G.; Schaaf, J.; Luellig, H.; Vogt-Moykopf, I.; Delphendahl, A. *Fortschritte auf dem Gebiete der Roentgenstrahlen und der Nuklearmedizin;* **134**: No. 6, 601-607(Jun 1981). (In German).

Pre-operative staging was carried out in 52 out of 112 patients suspected of having bronchial carcinomas, using computed tomography and conventional radiology. CT was superior in demonstrating tumour infiltration of the mediastinum, of the thoracic wall and of metastases in mediastinal lymph nodes. Conventional radiology was better for demonstrating intrabronchial tumour and metastases of bronchiopulmonary lymph nodes. By extending CT to the upper abdomen, it was possible to show metastases in 18% of patients.

28582 **Improved radiographic diagnosis of expanding lesions of the thoracic wall by computer tomography.** Lackner, K.; Weiand, G.; Koester, O. *Fortschritte auf dem Gebiete der Roentgenstrahlen und der Nuklearmedizin;* **134**: No. 6, 607-613(Jun 1981). (In German).

The findings of conventional radiography were compared with the results of computer tomography in 91 patients with histologically confirmed lesions of the thoracic wall. In 22 CT gave no additional information. In 67 CT supplied additional information or narrowed the differential diagnosis. Particularly important on computer tomography was the enhancement brought about by intravenous contrast medium in malignant tumours of the thorax or thoracic wall. CT should be used in preference to conventional tomography in the investigation of lesions of the thoracic wall.

28583 **Fibrous pleural mesothelioma (pleura fibroma).** Stark, P. *Fortschritte auf dem Gebiete der Roentgenstrahlen und der Nuklearmedizin;* **134**: No. 6, 614-619(Jun 1981). (In German).

Five cases of mesothelioma are described, their clinical and radiological findings are analysed and the results compared with those in the literature. The lesion is a benign pleural tumour which rarely causes symptoms; it is usually found accidentally, but can reach an extraordinary size. Surgical removal results in cure. Only a small proportion recur. Distant metastases are not found. Even when there is a recurrence, cure can be attained by a second operation.

28584 **Calcified pleural scars and pleural empyema with mural calcification.** Schmitt, W.G.H.; Huebener, K.H. *Fortschritte auf dem Gebiete der Roentgenstrahlen und der Nuklearmedizin;* **134**: No. 6, 619-625(Jun 1981). (In German).

The differential diagnosis between calcified pleural scars and pleural empyemas with mural calcification was studied by computer tomography, bearing in mind the patient's history. In view of the high complication rate of pleural empyemas, such as internal or external fistulae, it is desirable to elucidate every form of pleural shadowing which is more than 20 mm thick. Criteria are offered, which permit the differentiation of the pleural changes by means of conventional radiological examinations. Valuable additional information can be obtained by computer tomography. Forty-nine patients with calcification in the pleura were found among 1.900 chest x-rays which had been examined. Out of these, seven had a pleural empyema. In one case an echinococcus cyst with mural calcification was punctured under X-ray control.

28585 **Castleman's giant lymph node hyperplasia.** Stark, P. *Fortschritte auf dem Gebiete der Roentgenstrahlen und der Nuklearmedizin;* **134**: No. 6, 625-628(Jun 1981). (In German).

Castleman's giant lymph node hyperplasia was first described in 1954 as a mediastinal space-occupying lesion. The condition can affect any peripheral group of lymph nodes, but is found principally within the thorax as a mediastinal, hilar or paravertebral mass. Four cases are described and the clinical, radiological and pathological features are discussed.

28586 **Mammographic parenchymal pattern and risk of breast cancer.** Hueppe, J.R. *Fortschritte auf dem Gebiete der Roentgenstrahlen und der Nuklearmedizin;* **134**: No. 6, 638-642(Jun 1981). (In German).

502 breast cancers with 431 prevalent and 71 incident carcinomas and 3633 patients without breast cancer were classified according to the mammographic parenchymal pattern N_1, P_1, P_2, Dsub(y) devised by Wolfe. The percentage of carcinomas in the various parenchymal groups were determined seperatley for prevalent and incident carcinomas divided by age groups. Risk factors were achieved by comparison of carcinoma prevalence and incidence between N_1 and the other parenchymal groups separately for each age group. The mean risk factor of all age groups shows a slight increase for carcinoma prevalence with 1,0 in P_1 and N_1 to approximately 1,5 in P_2 and 3,0 in Dsub(y). The ascertained risk factors for carcinoma incidence indicate a similar tendency, however in view of the statistically small number of incident carcinomas as final answer cannot yet be given. The risk trend for N_1/P_1 to P_2/Dsub(y) as asserted by Wolf can thus be confirmed qualitatively. However the risk factors seem to be of considerably lesser magnitude than assumed by Wolfe.

28587 Electro-thrombosis. Sedlarik, K.; Deckert, F. *Fortschritte auf dem Gebiete der Roentgenstrahlen und der Nuklearmedizin;* **134**: No. 6, 643-648(Jun 1981). (In German).

The use of a suitable direct current applied to a vessel wall by an electrode results in the formation of a thrombus. Firm contact between the intravascular anode and the endothelium is necessary to obtain a strictly localised thrombus. The use of a direct current of 10 to 30 mA. for a period of 15 minutes results in the certain thrombotic occlusion of an artery of 5 mm. diameter. The method is an effective alternative to vascular embolisation used as a preoperative or palliative procedure. Animal experiments and our own clinical experience are described and discussed.

28588 Angiographic problems in angiomyolipoma of the kidney. Gospos, C.; Boehm, N.; Friedburg, H. *Fortschritte auf dem Gebiete der Roentgenstrahlen und der Nuklearmedizin;* **134**: No. 6, 653-656(Jun 1981). (In German).

3 cases of unilateral angiomyolipoma of the kidney are presented. Angiography was unsuccesful in diagnosing angiomyolipoma in these cases observed by us. The diagnostic problems of the angiomyolipoma are discussed on the basis of histologic and angiographic findings. No patient showed simultaneously tuberous sclerosis.

28589 Role of computer tomography in staging of carcinomas of the bladder. Luetgemeier, J.; Wunschik, F.; Hoerst, M. *Fortschritte auf dem Gebiete der Roentgenstrahlen und der Nuklearmedizin;* **134**: No. 6, 661-665(Jun 1981). (In German).

Carcinomas of the bladder can be demonstrated in various ways, such as examination with contrast medium before and after micturition, and filling with CO_2 as suggested by Seidelmann. The procedure should be chosen depending on one's aim. We examined patients who had already been diagnosed when the bladder was full of urine, in order to confirm doubtful findings, and after micturition in order to demonstrate the smallest volume to which radiotherapy can be given. Computer tomography has proved valuable; in 33% of 54 patients staging had to be revised upwards.

28590 Plain X-ray studies of bone material in the repair of fractures. Langer, M.; Langer, R.; Maier, W.; Kinzl, L.; Rudzki, M. *Fortschritte auf dem Gebiete der Roentgenstrahlen und der Nuklearmedizin;* **134**: No. 6, 666-668(Jun 1981). (In German).

Ten patients who had had osteosynthetic repairs of bone defects carried out by means of bone grafts were studied. It was shown that magnification radiography permitted better and more complete evaluation of the healing process. Trabecular bone structure can be recognised and changes in the configuration and position of the trabeculae during their incorporation into the bone can be evaluated.

28591 Xeroradiography of soft tissue tumors. Nessi, R.; Gattoni, F.; Mazzoni, R.; Coopmans de Yoldi, G.; Veronesi, U. *Fortschritte auf dem Gebiete der Roentgenstrahlen und der Nuklearmedizin;* **134**: No. 6, 669-673(Jun 1981).

The main features of 300 consecutive cases of soft tissue tumors at xeroradiography were submitted to retrospective evaluation. The parameters assessed were: visibility, density, shape, size, outline and relationships of the lesions. The distribution of each parameter between benign and malignant tumors was evaluated by means of statistical analysis. The xerographic signs of malignancy of soft tissue tumors are reviewed and the typical features of some particular tumors are outlined.

28592 Roentgen morphological aspects of the structure of the oesophagus. Ernst, H.; Groenninger, J. *Fortschritte auf dem Gebiete der Roentgenstrahlen und der Nuklearmedizin;* **134**: No. 6, 674-677(Jun 1981). (In German).

The clinically most important disturbance of the function of esophagus is that of esophago-gastric area. Because there is uptil now no recognized opinion about the mechanism of the esophago-gastric sphincter, there are a lot of theories about that. In our own radiologic studies of the esophagus we were able to demonstrate in a low percentage the intern muscularies mucosae. The structure of these intern folds of the muscularis mucosae are like a spiral line or a screw, this is in accordance with the direction of muscle bundles of the theories of Muscular Strech Closure Function of the Terminal Esophagus by Stelzner and Lierse.

28593 Gastric secretory inhibitors improve the visibility of gastric mucosal detail in barium studies of the stomach. Bruehlmann, W.; von Bueren, U.; Zollikofer, C.; Mueller-Lissner, S.; Blum, A. *Fortschritte auf dem Gebiete der Roentgenstrahlen und der Nuklearmedizin;* **134**: No. 6, 681-684(Jun 1981). (In German).

In a controlled randomized clinical trial the effect of the secretory inhibitors Cimetidine and Pirenzepine on the visibility of the areolae gastricae in barium studies of the upper gastrointestinal tract was examined. Both drugs improved the radiological imaging of the areolar pattern. Pirenzepine but not Cimetidine reduced the amount of radiologically visible fasting gastric contents. Thus, factors other than the volume alone of gastric secretions appear to play a major role in the quality of imaging of the gastric fine relief.

28594 Complete stomach erosions, quality of contrast media and possible errors. Treichel, J. *Fortschritte auf dem Gebiete der Roentgenstrahlen und der Nuklearmedizin;* **134**: No. 6, 684-686(Jun 1981). (In German).

28595 Leiomyosarcoma of the Vena cava superior. Vogel, H.; Kalmar, P.; Knop, J.; Runge, M.; Wolf, W. *Fortschritte auf dem Gebiete der Roentgenstrahlen und der Nuklearmedizin;* **134**: No. 6, 691-692(Jun 1981). (In German).

28596 Chemodectoma, multiple localization. Oudkerk, M.; Falke, T.H.M. *Fortschritte auf dem Gebiete der Roentgenstrahlen und der Nuklearmedizin;* **134**: No. 6, 693-694(Jun 1981).

28597 Scimitar syndrome in newborn. Wildanger, A.; Djebbar-Ritz, N. *Fortschritte auf dem Gebiete der Roentgenstrahlen und der Nuklearmedizin;* **134**: No. 6, 699-700(Jun 1981). (In German).

28598 Malignant renal tumor with marked AV shunt. Gauss, G.; Talazko, H. *Fortschritte auf dem Gebiete der Roentgenstrahlen und der Nuklearmedizin;* **134**: No. 6, 700-701(Jun 1981). (In German).

28599 Visualization of an arteria proatlantica intersegmentaria by puncture of the arteria pharyngea ascendens. Brainin, M.; Donner, K. *Fortschritte auf dem Gebiete der Roentgenstrahlen und der Nuklearmedizin;* **134**: No. 6, 702-704(Jun 1981). (In German).

28600 Angiographic aspects of extra-intracranial arterial bypass (EIAB) for cerebral arterial occlusive disease. Bradac, G.B.; Kaernbach, A.; Schramm, J.; Oppel, F. *Neuroradiology;* **20**: No. 3, 111-122(Nov 1980).

Fifty extra-intracranial arterial anastomoses were performed in 48 patients. The importance of a precise angiographic study in the pre- and post-operative period is emphasized. The different angiographic patterns of the anastomosis, its variation in time, the possible cause of failure, and the role played by the EIAB on the cerebral blood flow are described and discussed. The problems of extension and time of the postoperative angiographic examination, are also discussed.

28601 Aneurysms of the vein of Galen in children: CT and angiographic correlations. Martelli, A.; Scotti, G.; Harwood-Nash, D.C.; Fitz, C.R.; Chuang, S.H. *Neuroradiology;* **20**: No. 3, 123-133(Nov 1980).

At the Hospital for Sick Children six patients with an aneurysm of the vein of Galen were studied by angiography and CT. Four of them were newborn in cardiac failure. Angiography was essential for the accurate demonstration of all the feeding vessels to the malformation and their exact location. Computed tomography also added useful information on associated hydrocephalus and is-

chemic brain damage. The dilated vein of Galen, straight sinus and torcular were clearly seen. Abnormal arterial vessels feeding the malformation were also recognized.

28602 **Atlantoaxial arthrography.** Mellstroem, A.; Grepe, A.; Levander, B. *Neuroradiology;* **20**: No. 3, 135-144(Nov 1980).

The atlantoaxial joints of nine cadavers were examined with Amipaque. A lateral percutaneous approach was elaborated. Interarticular communications and pertinent anatomical features were analyzed.

28603 **Postpartum CT examination of the heads of full term infants.** Ludwig, B.; Brand, M.; Brockerhoff, P. *Neuroradiology;* **20**: No. 3, 145-154(Nov 1980).

Intracranial hemorrhage and decreased density of the cerebral parenchyma were the major findings on CT of 150 full term newborns in the first week of life. Clinically silent hemorrhage was rare. All neonates with severe intracranial bleeding had neurological abnormalities. A correlation was not found between hemorrhage and the mode of delivery. The site of hemorrhage has an important bearing on brain development. Periventricular hypodensity is an ambiguous finding which should be interpreted in conjunction with the clinical findings.

28604 **Non-pyogenic focal encephalitis diagnosis and follow-up by computed tomography and nuclear brain scanning.** Probst, F.P. *Neuroradiology;* **20**: No. 3, 155-158(Nov 1980).

A localized brain affection in a 10-year-old girl was closely followed for 2 1/2 years by means of EEG, nuclear brain scans, angiography and computed tomography. Owing to the absence of angiographic evidence of an arterial occlusion, the possibility of an infarct was abandoned and a tentative diagnosis of focal encephalitis, probably viral in origin, was made. The necessity of arriving at such a diagnosis by exclusion of other possibilities rather than by the positive demonstration of the causative agent is discussed. The importance of neuroradiological methods in stressed.

28605 **Capillary radioimmunoassay for insulin.** Zick, R.; Schweer, H.H.; Mitzkat, H.J.; Friedel, R. *European Journal of Nuclear Medicine;* **5**: No. 5, 423-425(Oct 1980).

Capillary radioimmunoassay - a modification of the coated tube technique - is described. The assay is equivalent (accuracy, sensitivity, precision) to conventional methods for insulin determination; it overcomes, however, the necessity of centrifugation or filtration and offers the added bonus of being automation compatible.

28606 **Colloid clearance rate changes in children with homozygous-β-thalassemia in relation to blood transfusion.** Dimitriou, P.A.; Karpathios, T.E.; Antipas, S.E.; Fretzayias, A.M.; Kasfiki, A.G.; Melissinos, K.G.; Matsaniotis, N.S. *European Journal of Nuclear Medicine;* **5**: No. 5, 427-430(Oct 1980).

The plasma clearance rate of heat denatured human serum albumin (DHAI-125, 5 mg/kg body weight) was studied in 20 children with homozygous-β-thalassemia before and 7-10 days after blood transfusion. A significant increase of the DHAI-125 clearance rate ($P < 0.02$) was found 7-10 days after blood transfusion while the spleen presented its minimum size. This finding may be relevant to the improved intrasplenic blood circulation after blood transfusion due to the release of the blood trapped within the spleen.

28607 **New radioisotope for lung ventilation studies: 19-neon.** Crouzel, C.; Guenard, H.; Comar, D.; Soussaline, F.; Loc'h, C.; Plummer, D. *European Journal of Nuclear Medicine;* **5**: No. 5, 431-435(Oct 1980).

Neon 19, a 17-second positron-emitting radioelement, is produced continously by 23 MeV alpha particle bombardment of oxygen. For a 12 μA particle current the method of preparation described delivers 14 mCi of neon 19 per min to the functional exploration room. The radiochemically pure radioactive gas is diluted in air and breathed continously by the patient lying under a positron tomographic camera. The regional lung ventilation distribution is obtained on 2 cm thick sections of organ with a transverse resolution of 17 mm. Quantification of the ventilation output per unit lung volume is contemplated.

28608 **Use of finite-memory Wiener filters in scintigram processing.** de Larminat, P.; Lemort, J.P.; Bizais, Y. *European Journal of Nuclear Medicine;* **5**: No. 5, 447-452(Oct 1980).

Scintigraphic images are subject to two forms of imperfection: blurring due to the components of the detector (collimator, photomultiplier, analog processing devices) and noise resulting from radioactive disintegration. We use Wiener filters operating within a limited area of the spatial domain in processing these images. After defining statistical models of ideal image and degrading processes, we study the effects of the parameters on filter features. Finally, we present examples demonstrating filter performance.

28609 **Lateral ventricle visualization during brain scanning with Tc-DTPA.** Steinling, M.; Marchandise, X.; Vergnes, R.; Warst, P. *European Journal of Nuclear Medicine;* **5**: No. 5, 453-457(Oct 1980).

The visualization of cerebral ventricles during a brain scan is a relatively rare possibility. The authors had the opportunity of observing four cases. They report then and discuss the 19 cases reported in world literature. There were, in order of importance, 12 cases of ventriculitis, 3 of non tumorous intraventricular erruptions, 2 of tumorous infiltration, 1 metabolic encephalopathy and one unexplained case. It is concluded that the visualization of the ventricule during a brain scan (particularly the early visualization) is a good etiological indicator of ventriculitis.

28610 **Sacro-iliac joint disease in drug abusers: The role of bone scintigraphy.** Lopez-Majano, V.; Miskew, D.B.W. *European Journal of Nuclear Medicine;* **5**: No. 5, 459-463(Oct 1980).

Bone scintigrams demonstrated increased uptake in the sacroiliac joint in twenty drug addicts with low back pain and signs of localized sepsis. The localization of the disease was decisive for the orthopedist in the aspiration of the affected joint.

28611 **Case of thymoma arising from undescended thymus.** Fukuda, T.; Itami, M.; Sawa, H.; Furukawa, T.; Fukakusa, S.; Tsuchihashi, N.; Kakehi, H.; Takahashi, Y.; Fujimoto, Y.; Futonaka, H. *European Journal of Nuclear Medicine;* **5**: No. 5, 465-468(Oct 1980).

We present an unusual case of a cervical thymoma arising from an undescended thymus, which showed a remarkable accumulation of Thallium-201 Chloride on scintigraphy.

28612 **Dependence of an individual renogram on the other kidney through the blood activity, shown by convolution.** de Lima, J.J.P. *European Journal of Nuclear Medicine;* **5**: No. 5, 469-470(Oct 1980).

28613 **Effect of unilateral dominance of the cerebral hemispheres on the radiographic appearance of the cervical spine.** Jirout, J. *Radiologe;* **20**: No. 10, 466-469(Oct 1980). (In German).

The results of dynamic radiographic studies of the cervical spine following isometric exercise of the shoulders and the upper extremities appear to indicate that the commonly seen asymmetries of the joints in the craniocervical and cervicothoracic junction are due to asymmetry in the function of the muscles. The obvious dominance of the muscles on the right side demonstrates the dominance of the left cerebral hemisphere. The clinical importance of this is pointed out.

28614 **Constitutional stenosis of the lumbar spinal canal.** Wackenheim, A.; Vallier, D.; Babin, E. *Radiologe;* **20**: No. 10, 470-477(Oct 1980). (In German).

The radiographic findings of lumbar spinal stenosis are presented with special reference to the constitutional form and the cheirolumbar dysostotic form as well as the pathologic changes associated with diffuse developmental anomalies of the skeleton.

28615 Lumbosacral radiculography (myelography). Hammer, B. *Radiologe;* **20**: No. 10, 478-484(Oct 1980). (In German).

A report is given on lumbosacral myelography (radiculography) with special reference to technique and contrast agents used - all based on clinical and experimental experience. The use of water-soluble contrast material is recommended. The non-ionic metrizamide (Amipaque) seems to be the agent of choice because of its inertia to cause adverse leptomeningeal changes. Also, another non-ionic contrast agent Jopamidol seems very promising. The non-ionic contrast media are to be applied in a concentration isotonic to that of the CSF; this is also sufficient to even show fine structures. Though the new contrast media exhibit low neurotoxity, they are not inert. Therefore, the application of very careful technique and the limitation of amount and concentration of the contrast medium to as low as possible are indispensable. The radiation dose to spine and gonads was found to be tolerable.

28616 Spinal computed tomography. Sartor, K. *Radiologe;* **20**: No. 10, 485-493(Oct 1980). (In German).

From 15. annual meeting of the Deutsche Gesellschaft fuer Neuroradiology e.V.; Mannheim, Germany, F.R. (10 - 12 May 1979).

Computed tomography (CT) of the spine and spinal cord is gaining more and more importance as a valuable investigative method in neuroradiology. Performed as a noninvasive procedure, with or without intravenous contrast enhancement, it can be used to diagnose paravertebral soft tissue lesions, constrictive lesions of the bony spinal canal, structure changes of the vertebral column or of individual vertebrae, vascular intraspinal lesions, and intraspinal tumors with abnormally high or abnormally low attenuation values. Performed as an invasive procedure, after intrathecal introduction of metrizamide, spinal CT can in selected cases be used in conjunction with conventional metrizamide myelography as an additional procedure (secondary CT-myelography) or even as initial procedure (primary CT-myelography), taking advantage of its unique properties, namely to provide a transverse axial image of the spine and related soft tissue structures and to detect even small differences in density. Further improvement of spinal CT, particularly the routine non-invasive demonstration of the intraspinal soft tissues, is to be expected.

28617 Treatment of renovascular hypertension by catheter dilatation. Mathias, K.; Billmann, P.; Liebig, R.; Kroepelin, T.; Thierfelder, K. *Radiologe;* **20**: No. 10, 494-499(Oct 1980). (In German).

Percutaneous transluminal angioplasty in renal artery obstructions was performed in 10 cases. In 7 patients the hypertension was successfully treated and in one patient renal function could be restored. The procedure can be applied in atherosclerotic and fibromuscular stenoses as well as in stenosis of kidney grafts. In our opinion catheter dilatation should be prefered to vascular surgery, because it is efficient and inexpensive and has a low risk. Operation should be reserved to cases untreatable with angioplasty.

28618 Lymphangioleiomyomatosis. Koch, H.K.; Bertram, E.; Lesch, R. *Radiologe;* **20**: No. 10, 500-504(Oct 1980). (In German).

Four different cases (diffuse interstitial lung fibrosis with leiomyomatosis, Lymphangioleiomyomatosis of the lung, fibroleiomyoma of the lung and adenomyofibroma of the lung) are presented and the differential diagnosis criteria are discussed. On survey of the literature on Lymphangioleiomyomatosis it is concluded that so far this diagnosis seems ill defined. As it cannot be excluded that the cases described so far represent an assortment of various diseases with different etiology, the authors believe that it is impossible to give a reliable statement on prognosis either for the condition in general or for an individual case.

28619 Comparison of bone scanning and radiology in the assessment of patients with symptomatic Paget's disease. Fogelman, I.; Carr, D. *European Journal of Nuclear Medicine;* **5**: No. 5, 417-421(Oct 1980).

Bone scans and X-rays from 23 subjects with symptomatic Paget's disease were evaluated. One-hundred and twenty-seven sites of Pagetoid involvement were found, of which 120 (94.5%) were recognised on the bone scan as compared to 94 (74%) on X-ray. The anatomical distribution and relationship of lesions on scan and X-ray to the patient's symptoms are also discussed. It is concluded that the bone scan is more sensitive than radiology in detecting Paget's disease and only rarely will a lesion that is seen on X-ray not be visualised by scanning.

28620 Validity of different gated equilibrium blood pool methods for determination of left ventricular ejection fraction. Karsch, K.R.; Schicha, H.; Rentrop, P.; Kreuzer, H.; Emrich, D. *European Journal of Nuclear Medicine;* **5**: No. 5, 439-445(Oct 1980).

Left ventricular ejection fractions (EF) were determined in 37 patients by biplane cineventriculography (Angio) and by four modifications of the gated equilibrium blood pool (GBP) method: 1. Region of interest (ROI) in enddiastole (ED), correction by external background, 2. ROI in ED, correction by internal background between ED and endsystole (ES), 3. ROI in ED (maximum) and ES (minimum); no background correction, 4. ROI in ES, correction by background between ED and ES. EFsub(GBP) were determined after injection of 20 mCi sup(99m)Tc human albumin (Anger-camera, all-purpose collimator, 16 ECG-segments, 64 x 64 matrix with 1.5 zoom). EF by biplane angiography (EFsub(angio) was calculated by the formula of Dodge. The following correlation between angiographically and scintigraphically determined EF's were found: EFsub(GBP1) = 0.504 EFsub(angio) +8.08, EFsub(GBP2) = 0.847 EFsub(angio) +10.0, EFsub(GNP3) = 0.911 EFsub(angio) +3.75, EFsub(GBP4) = 0.648 EFsub(angio) - 3.51. Intraobserver variability of GBP method 2 and 3 was +-5%. EFs determined by GBP methods 2 and 3 are as accurate as the EFs determined by cineventriculography.

28621 Cerebral computed tomography. Kazner, E. *Medizinische Welt;* **31**: No. 39, 1438-1449(26 Sep 1980). (In German).

28622 TI-201-imaging as a follow-up method after left ventricular aneurysmectomy. Eichstaedt, H.; Groeber, L.; Feine, U.; Kochsiek, K. *Fortschritte auf dem Gebiete der Roentgenstrahlen und der Nuklearmedizin;* **133**: No. 3, 245-249(Sep 1980). (In German).

Thallium myocardial scanning was performed in 30 patients after aneurysma resection of left ventricle. The aim of the study was to try an assertion about the completenes of adaptation of the marginal zones of aneurysma and about the postoperative reduction of left ventricular size. After standardization of size and distance of pictures we suggested quantification of dimensions of left ventricle by counting picture-points using a computer matrix. For that purpose left ventricle had to be deliminated exceptional distinctly from the background. That intention was realized by an interpolating background subtraction. Postoperatively an evident reduction of heart size, especially of ventricle cavity could be proved. Thallium myocardial scanning therefore seems to be suitable for postoperative supervision after aneurysma resection too.

28623 Scintigraphic features of cirrhosis of the liver. Bell, E.; Biersack, H.J.; Altland, H.; Albrecht, M.; Winkler, C. *Fortschritte auf dem Gebiete der Roentgenstrahlen und der Nuklearmedizin;* **133**: No. 3, 292-295(Sep 1980). (In German).

A retrospective study of 101 patients with histologically confirmed cirrhosis of the liver and portal hypertension was carried out in order to evaluate the accepted scintigraphic criteria. In only 20% were all the essential criteria present. The absence of generally accepted important scintigraphic signs does not exclude the diagnosis of cirrhosis of the liver. Specificity of liver scintigraphy in cirrhosis of the liver is fairly low, but sensitivity of the method is almost 100%.

28624 Noninvasive possibilities of X-ray diagnostic on prosthetic heart valves. Wolf, W.; Spiel, R. *Roentgen Blaetter;* **33**: No. 9, 427-434(Sep 1980). (In German).

Characteristic mechanical qualities and possibly occurring complications are discussed in this paper. Noninvasive X-ray diagnostic with chest radiographex, fluoroscopy and 78 mm camera

makes possible an exact identification of any prosthetic valve. If there is any clinical suspicion, negative X-ray findings will not exclude malfunction of the prosthesis. Invasive diagnostic proceeding is necessary in such cases.

28625 **Abnormal positioning of central venous catheters.** du Mesnil de Rochemont, W.; Heymer, R. *Roentgen Blaetter;* 33: No. 9, 435-444(Sep 1980). (In German).

The increasing use of central venous catheters requires acurate knowledge of the dangers and risks associated therewith. In general, it is possible to recognize wrong positioning of the catheters when studying the fullsize roentgenographs of the thorax. In some cases, however, it may become necessary to effect additional roentgenographs for better clarification and control after correcting the position.

28626 **Significance and ranking of the oesophagus in modern X-ray diagnosis of the stomach.** Nebel, G.; Holzkamp, J. *Roentgen Blaetter;* 33: No. 9, 445-448(Sep 1980). (In German).

A clientele of 102 patients who were sent for an X-ray study of the stomach only, presented with pathologic findings in the oesophagus unknown to the clinician. We conclude that just a surveying look at the oesophagus under fluoroscopy connection with an X-ray study of the stomach appears to be insufficient.

28627 **Duplicature of the duodenum.** Hermanns, P.M.; Bojanowski, G.; Iben, G.; Lueth, G.; Pokahr, A. *Roentgen Blaetter;* 33: No. 9, 449-452(Sep 1980). (In German).

A case of duodenal duplication in an adult is presented with endoscopic, radiographic and operative findings. Successful therapy consisted in retromesocolic duodenal-duplication-jejunostomy. The literature concerning congenital duplications of the small intestine - especially duodenal duplications - is reviewed.

28628 **X-ray examination of the operated intestine in Crohn's disease.** Guertler, K.F.; Erbe, W. *Roentgen Blaetter;* 33: No. 9, 453-458(Sep 1980). (In German).

Since Crohn's disease often entails complications, surgery is mandatory in many cases. The postoperative relapse rate is high (50-90%). The most important method to discover such relapses is represented by X-ray examination. In 15 surgically treated cases, relapses were observed in 7 patients. The region of the anastomosis is most frequently affected by relapses and complications. Optimal information in respect of differentiation of purely surgically conditioned changes and relapses is given by enteroclysm and double-contrast roentgenography of the colon.

28629 **Value of the direct X-ray magnification technique for the assessment of the therapeutic success in osteochondrosis dissecans in the knee-joint.** Langer, M.; Langer, R. *Roentgen Blaetter;* 33: No. 9, 459-462(Sep 1980). (In German).

The article demonstrates the diagnostic value of the direct X-ray enlargement technique, taking a group of 11 patients with osteochondrosis dissecans of a femoral condylus as an example. The method is unsuitable as a diagnostic screening method, since the informative content of the enlarged roentgenograph, compared with the standard roentgenograph, is greater in a defined area only, and since the additional exposure burden should not be overlooked, especially in the patients in question, who are mostly relatively young. However, the direct radiological enlargement technique is well suited for postoperative follow-up, since it is only with the help of visualization of the increasing trabecular bone bridges between femoral condylus and dissecate, that the process of incorporation can be visualized and hence also judged in respect of its success.

28630 **Miction cystourethrography effected on-target by X-ray examinations and executed under physiological conditions.** Hruby, W.; Schramek, P. *Roentgen Blaetter;* 33: No. 9, 463-467(Sep 1980). (In German).

A conventional method in pediatric urology is recalled, regarding the investigation of obstructive mictiurition difficulties in males. The value of the voiding cystourethrogram, performed by means of fluoroscopy in standing position following excretory urography, is evaluated in fifty patients with the conventional method (retrograde cystourethrogram). According to the gratifying results and to the improved radiological technique, this method can now be suggested as a screening examination.

28631 **Diagnosis of an upper abdominal tumor by computed tomography.** Kuckein, D. *Roentgen Blaetter;* 33: No. 9, 468-470(Sep 1980). (In German).

In this case of a pulsating upper abdominal tumor an angiographic examination was indicated even though an aortic aneurysm had been excluded and the affected organ identified by means of sonography and computed tomography.

28632 **Diagnosis via soft roentgenography of the distal third of the lower arm.** Seyss, R. *Roentgen Blaetter;* 33: No. 9, 471-474(Sep 1980). (In German).

For the purpose of interpreting changes in the soft parts on conventional skeleton roentgenographs, particularly from an anatomical point of view, the article demonstrates soft roentgenographs of the lower arm. For example, it is usually possible to visualize the quadratotendinosal space in good delineation, especially in volar flexion. It is also possible to recognize the tendons of the musc. carpi ulnaris or radialis with slight radial or ulnar pronation. An area of increased translucence can be visualized at the tip of the radius. The article concludes with a few hints on practical diagnostics.

28633 **Quality control of roentgen equipment with automatic exposure using a newly developed test phantom. Pt. 2.** Hagemann, G. *Roentgen Blaetter;* 33: No. 9, 475-482(Sep 1980). (In German).

The article reproduces further results of quality control test conducted with 42 automatically exposed roentgenographs of a test phantom, for the parameters surface dose (Dsub(o)), film-distant (Asub(F)) and filmproximal (Asub(N)) resolution, optical density of dominant (Ssub(Dom)), film contrast (Ksub(F)) and size of focus. By means of definition of the quality number $z = Asub(N) \times Asub(F)/\log_{10} \times Dsub(o)$, it is possible to state the sequence of qualitatively different X-ray films and to plot this against $\log_{10} t$ to take organ movements into consideration, thus supplying a simple criterion of the quality of Roentgen equipment. Good equipment will yield values of $z/\log_{10} t = 3$, whereas medium-quality and insufficently equipped apparatus will yield values around 2 or 1, respectively, or even below this figure. If the values are too low, analysis of all data obtained with the test phantom will supply indications with regard to the possible causes. Of the 42 X-ray films tested in this study, the $z/\log_{10} t$ values were above 2 in 15 cases, and below 2 in the same number of cases. Variations in the size of focus, optical density of dominant and contrast, are shown in the diagrams and described quantitatively by their average values and standard errors.

28634 **Volume controlled fixation of the lung by formalin vapor. Pt. 1.** Rau, W.S.; Mittermayer, C. *Fortschritte auf dem Gebiete der Roentgenstrahlen und der Nuklearmedizin;* 133: No. 3, 233-239(Sep 1980). (In German).

A new method of lung fixation by formalin vapor is presented. A simple Engstrom type respirator modified for postmortem formalin insufflation of the lung was developed. Rapid fixation requires use of hot formalin vapor which would destroy available equipment. The main advantage compared to other described methods beside the constant volume is sufficient stirring of formalin and formalin vapor. In order to prevent condensation of water within the lung parenchyma any cooling of the vapor should be avoided. If the lungs are fixed by this method the tissue will stiffen in a position between in- and exspiration. Slices of 1 cm are cut. Radiographs in soft tissue technique guarantee unusual high resolution. Positive findings are identified easily and furthermore studied by microscopy: the direct correlation between X-ray finding and microscopy becomes possible.

28635 **Metal pneumoconiosis.** Frank, A.; Nissl, R. *Fortschritte auf dem Gebiete der Roentgenstrahlen und der Nuklearmedizin;* 133: No. 3, 240-244(Sep 1980). (In German).

The occurrence of two cases of metal pneumoconiosis in a metal works has been used to draw attention to this rare occupational disease. The technology for the manufacture and precessing is described with special reference to dust exposure at the various stages. After an historical review, there is a detailed discussion of the clinical and radiological features of the two cases. Problems concerning the prognosis, differential diagnosis and the laws concerning compensation are discussed.

28636 CT demonstration of venous collaterals with occlusion or agenesis of the vena cava. Weiand, G.; Lackner, K.; Koischwitz, D. *Fortschritte auf dem Gebiete der Roentgenstrahlen und der Nuklearmedizin;* **133**: No. 3, 250-258(Sep 1980). (In German).

The value of computer tomography in the demonstration of venous collaterals in cases with occlusion or malformation of the superior and inferior vena cava has been demonstrated in five patients. The ascending lumbar veins and the vena azygos are of special significance in the formation of collaterals.

28637 Percutaneous catheter dilatation of carotid stenoses. Mathias, K.; Mittermayer, C.; Ensinger, H.; Neff, W. *Fortschritte auf dem Gebiete der Roentgenstrahlen und der Nuklearmedizin;* **133**: No. 3, 258-261(Sep 1980). (In German).

Thirty-one carotid artery stenoses were produced in thirty dogs by three different techniques. Twenty-three of these could be cured by transfemoral percutaneous catheter dilatation. High grade tight stenoses may present resistance which cannot be overcome by the catheter. Histological examination of the dilated vessels showed circumscribed changes in the vessel wall, with destruction of elastic membranes. From our experience of catheter dilatation of pelvic and lower limb arteries and of renal arteries, we consider it feasible to use this technique in selected patients with carotid stenosis.

28638 Roentgenologic aspects after (total) gastrectomy for malignant tumours. Fritsch, R.; Meyer, H.J. *Fortschritte auf dem Gebiete der Roentgenstrahlen und der Nuklearmedizin;* **133**: No. 3, 262-269(Sep 1980). (In German).

Pre-operatively, radiological examination is important for the diagnosis of malignant tumours in the stomach. Postoperatively, it can be used to demonstrate the state of the anastomosis and possible defects of the suture, for the early recognition of recurrences or other abnormalities, and for the diagnosis of reflux oesophagitis and the dumping syndrome. Changes in the oesophagus following various types of reconstruction were examined, both clinically and radiologically, in 40 patients who had had gastrectomies. Following jejunal interposition with a proximal end-to-side anastomosis and a long blind segment, there may be reflux into the oesophagus, but symptoms of reflux oesophagitis only occur if there is also duodeno-jejunal reflux. Patients with a Rouc loop show few symptoms, while the worst radiological and clinical results were achieved with a double-barrelled jejunal loop, despite a low anastomosis.

28639 Proof of the jejunogastric bile reflux after B II partial gastrectomy using sup(99m)Tc diethyl-IDA. Lammer, J.; Justich, E.; Dietrich, G.; Stadler, H. *Fortschritte auf dem Gebiete der Roentgenstrahlen und der Nuklearmedizin;* **133**: No. 3, 270-274(Sep 1980). (In German).

A history was obtained and barium meal and gastroscopy performed on 42 patients after a Billroth II partial gastrectomy. In order to demonstrate and quantify jejuno-gastric bile reflux, hepatobiliary sequential scintigraphy was carried out using sup(99m)Tc diethyl-IDA. The method has advantages over conventional techniques in that it is easy for the patient and demonstrates reflux both when the stomach is empty and full. The result showed that all patients who had evidence of inflammatory changes or ulcers on barium meal or gastroscopy had evidence of reflux.

28640 Dynamic double contrast small bowel enema. Salomonowitz, E.; Czembirek, H. *Fortschritte auf dem Gebiete der Roentgenstrahlen und der Nuklearmedizin;* **133**: No. 3, 274-278(Sep 1980). (In German).

A modification of the double contrast technique for examining the small bowel is described. This employs an infusion system with variable infusion pressure, which makes it possible to adjust the flow of contrast medium, methyl cellulose and water separately, permitting continuous double contrast demonstration of the entire small bowel. The ileum, which was poorly demonstrated by conventional double contrast methods, can be shown satisfactorily in a high percentage of cases (70%). Side effects and failures, which were frequent at first, have become less common with increasing experience.

28641 Percutaneously introduced bile duct prostheses as primary mease in obstructive jaundice. Rupp, N.; Weiss, H.D. *Fortschritte auf dem Gebiete der Roentgenstrahlen und der Nuklearmedizin;* **133**: No. 3, 279-284(Sep 1980). (In German).

The simplest measure for overcoming obstructive jaundice, and the one with the least complications, is percutaneous transhepatic bile duct drainage, which we have carried out on 38 patients. We have abandoned the catheter technique with combined external and internal drainage and instead use primary implantation of a bile duct prosthesis by the transhepatic route in cases of obstructive jaundice. The results are better, and the procedure is easier for the patient. Our experience with twelve implants in nine patients is described.

28642 Quantitative whole-body bone scintigraphy. Pt. 2. Anger, K.; Aigner, S.; Buehler, M.; Umbach, I. *Nuclear-Medizin (Stuttgart);* **19**: No. 3, 97-107(Jul 1980). (In German).

^{85}Sr, sup(99m)Tc-Sn-pyrophosphate and sup(99m)-methylene-diphosphonate, the most important agents for skeletal imaging, are compared with each other by calculation of the plasma clearance and the urinary excretion and by a series of quantitative whole-body scans. ^{85}Sr the distribution volume in equilibrium is the largest, shifting of activity is demonstrable for several days after injection. sup(99m)Tc-Sn-MDP is excreted most quickly, equilibrium is reached early. There is no significant difference in skeletal uptake between the phosphate complexes. The distribution however is different: ^{85}Sr is localized to a greater extent in the extremities, the phosphate complexes more in the trunk, sup(99m)Tc-Sn-MDP and ^{85}Sr nearer the joints than sup(99m)Tc-Sn-pyrophosphate.

28643 Quantitative whole-body bone scintigraphy. Pt. 3. Anger, K.; Kueper, K. *Nuclear-Medizin (Stuttgart);* **19**: No. 3, 108-119(Jul 1980). (In German).

Quantitative whole-body bone scans were performed on 277 patients with bone metastases, diseases of the joint and systemic bone diseases in order to evaluate the clinical significance of quantitative and kinetic data in bone imaging. Metastases and other focal bone diseases are recognizable and quantifiable by the method; however, sensitivity and specifity of bone imaging are not enhanced. In metabolic bone diseases, with the exception of osteoporosis, kinetic data facilitate the analysis of bone scans. Typical signs of osteomalacy, hyperparathyroidism and renal osteodystrophy - increased retention of the activity in the skeleton and increased bone/soft tissue ratios as well as generally changed distribution of radioactivity - are only recognizable by quantitative imaging.

28644 Combined radionuclide circulation and static imaging of the brain. Kempi, V.; Ritter, B.; von Scheele, C. *Nuclear-Medizin (Stuttgart);* **19**: No. 3, 120-126(Jul 1980).

Combined static and dynamic imaging of the brain was performed in 398 patients with suspected space occupying lesions. The imaging findings were analyzed from two points of view: Firstly, the radionuclide results were compared with pathological anatomical findings and, secondly, the diagnostic yield in patients with various symptoms was evaluated. Thus we obtained the number of false positive and false negative results. The findings of the combined imaging procedure were correctly negative in 85% of the patients with non-focal symptoms and false positive in only 1%. The circultion study alone gave false positive results in 7% and so did the static study alone. The combined imaging procedure was pathologic in 46 of 83 cases of space-occupying lesions (55%). There were only three patients in whom a pathologic circulation study was the only indication of a space-occupying lesion (4%). The static study alone gave correct positive findings in 23 more cases (28%). We conclude that a pathologic blood flow study alone is of limited interest. In the presence of a pathologic static study the cir-

culation procedure gives additional information, especially in meningioma and subdural hematoma. In patients with symptoms indicative of supratentorial space-occupying lesions of the brain combined imaging is recommended.

28645 **sup(99m)Tc-BIDA: Functional parameters in the differential diagnosis of obstructive and parenchymatous jaundice.** Passath, A.; Leb, G. *Nuclear-Medizin (Stuttgart);* **19**: No. 3, 127-139(Jul 1980). (In German).

75 Patients were examined with sup(99m)Tc-BIDA in order to find a reliable method of differentiating between obstructive and parenchymatous jaundice. Serial scans, repeated recordings of plasma radioactivity and external measurements over a temporal and a thigh region were taken between 1 and 30 min after injection. Serum half life of radioactivity, extraction coefficient and clearance rate, calculated from the first exponential slope over the temporal region curve, differed significantly in obstructive as compared to parenchymatous diseases and normals. In patients with extrahepatic obstruction the curves over the temporal and the thigh region differed; within the first 30 min the thigh values tend to increase. Clearance and extraction coefficients calculated from the third exponential slope of the plasma curve were significantly lower in obstructive jaundice than in other groups, although the great variation in these values did not allow a reliable differentiation in every patient. However, reliable results were obtained when these parameters were considered together with serial hepatic images.

28646 **Unusual cause of a possible misinterpretation of a liver scan.** Bell, E.; Franken, T. *Nuc Compact, Compact News in Nuclear Medicine;* **11**: No. 3, 84-86(Jun 1980). (In German).

On hand of a case report the possibility of absorption of gamma rays by intrathoracic masses is pointed out. This may lead - in some rare cases - to the misdiagnosis of a filling defect in the liver scan.

28647 **Success of therapy for reduction of goitre size.** Hengst, W.; Fasshauer, H. *Nuc Compact, Compact News in Nuclear Medicine;* **11**: No. 3, 87-91(Jun 1980). (In German).

221 predominantly young men were treated with thyroid hormones because of euthyroid goitre in the mean for the duration of 14 months. Reduction of goitre size was achieved in 90% of all patients, in 47% the amount was marked (-20% by quantification of thyroid scan), in 43% slight (-1%), in 10% the goitre increased (+21%). Concerning the antigoitrogenicity of therapy with T_4 or T_3-T_4-combination no significant difference could be shown up. TSH levels after TRH are decreased significantly in those patients who show goitre size reduction. The potential success of goitre size reduction therapy is related to goitre consistence, tender homogenously trapping goitres will respond to suppressive therapy, nodular goitres with inhomogenous scintigraphic pattern may even increase during therapy. By contrast, the destination of patients from areas with sporadic or endemic goitre, the existence of familiar goitre, the results of pretherapeutical in vitro tests as well as results of radioiodine uptake tests do not allow to predict efficiency of therapy.

28648 **Hormone metabolism in primary cancer and cirrhosis of the liver.** Scheuer, A.; Gruen, R.; Gropp, C.; Lehmann, F.G.; Mueller, R. *Nuc Compact, Compact News in Nuclear Medicine;* **11**: No. 3, 95-99(Jun 1980). (In German).

In patients with primary liver cancer due to cirrhosis and in patients with liver cirrhosis alone the plasma levels of the peptide hormones HGH, TSH, HPRL, FSH, ACTH, PTH, CT, α-HCG, β-HCG and the steroids testosterone, 5α-dihydrotestosterone, cortisol, dehydroepiandrosterone and oestradiol were determined. The hormone levels in patients with primary liver carcinoma were strongly influenced by the accompanying liver cirrhosis. None of the determined hormones are useful in primary liver carcinoma as a tumor marker.

28649 **Studies on the suitability of sup(99m)Tc-DTPA for evaluation of kidney function.** Gloebel, B. *Nuc Compact, Compact News in Nuclear Medicine;* **11**: No. 3, 104-108(Jun 1980). (In German).

The results show up that sup(99m)Tc-DTPA-complexes are not suitable for kidney function evaluation without special control. Commercially available labelling kits contain in part marked inhomogeneities which are time-dependent in addition. Using commercially available labelling kits for preparation of technetium complexes the radiochemical purity of the solution ready for injection has to be checked. In routine work there is not enough time between labelling and time of injection, therefore it is useful to standardize the labelling process, i.e. using identical volumes of eluate of the same technetium generator type, having once established that the respective technetium generator and the respective labelling kit under the chosen conditions will reveal pure and stable sup(99m)Tc-DTPA-complexes.

28650 **First experiences with commercial RIA kits for prostatic acid phosphatase (PAP).** Boettger, I.; Langhammer, H.; Pabst, H.W.; Sintermann, R. *Nuc Compact, Compact News in Nuclear Medicine;* **11**: No. 3, 110-115(Jun 1980).

Five commercial PAP RIA kits were intercompared by common RIA quality control criteria. All RIAs performed basically well although some differences existed in respect to concentration range, specific and non-specific binding, 50%-intercept, sensitivity and measurements of serum PAP in male and female controls. The latter finding may have been due to differences in antigen purity, antiserum specificity and composition of the assay medium employed. Good correlation was found between PAP determination by RIA and by enzyme assay. First measurements of PAP in patients treated for prostatic carcinoma being performed for orientation purposes are demonstrated. The PAP RIA has been introduced into our routine diagnostic and follow-up of prostatic carcinoma.

28651 **Detection of objects in digital pictures.** Hale, T.I. *Nuc Compact, Compact News in Nuclear Medicine;* **11**: No. 3, 116-118(Jun 1980).

Noninvasive radioisotope technique have become a useful tool in studying organ anatomy and function. The data obtained from these techniques are often corrupted by noise sources and detection of objects within regions of high background presents problems. A technique of digital picture differentiation is presented that has useful applications in organ boundary detection, sizing of organs and automatic positioning of regions of interest.

28652 **Radiation absorbed dose estimates to the embryo from some nuclear medicine procedures.** Husak, V.; Wiedermann, M. *European Journal of Nuclear Medicine;* **5**: No. 3, 205-207(Jun 1980).

Using the specific absorbed fractions reported by Smith and Warner, the radiation doses absorbed by the embryo in early pregnancy were calculated for various radiopharmaceuticals used in the diagnostic procedures of nuclear medicine. Radiopharmaceuticals are considered which are excreted predominantly through urine and cause the doses to the embryo to be 40%-90% higher than gonad doses. Also discussed are large differences of doses reported by various authors to the embryo by sup(99m)Tc-pertechnetate.

28653 **Physiologic tomography: a new means for the noninvasive measurement of myocardial metabolism, blood flow and function.** Schelbert, H.R.; Phelps, M.E. *European Journal of Nuclear Medicine;* **5**: No. 3, 209-215(Jun 1980).

Although radionuclide procedures for the non-invasive study of ventricular function and relative myocardial perfusion were developed only recently, their value for the diagnosis and management of cardiovascular disease has been readily recognized by many clinicians. These procedures are now part of the routine diagnostic work-up of cardiac patients in many institutions throughout the world. However, these conventional techniques are limited in two ways: The radiopharmaceuticals employed with these procedures are either largely unphysiologic or there is a limited understanding of their kinetics and mechanism of uptake. More importantly, traditional Anger type scintillation cameras compress or superimpose three-dimensional information into two-dimensional images and thus limit detailed perception of internal structures. Further, sensitivity and resolution of scintillation cameras decreases from the surface to the internal portions of the body. Lastly, gamma photons are attenuated to varying degrees by body tissues prior to reaching the scintillation camera. Because of superimposition of three-dimensional information, depth-dependent resolution

and varying degrees of photon attenuation, scintigrams obtained with conventional scintillation cameras provide only a qualitative indication of the distribution of radioindicators in organs. These images do not provide a capability for determining the local tissue concentration of a given radioindicator. Regarding conventional cardiovascular procedures, quantification of myocardial blood flow or ventricular volumes from count measurements alone is very limited.

28654 **Study of three-dimensional image expression of the left ventricle.** Asahara, A.; Ueda, H.; Wakabayashi, S. *European Journal of Nuclear Medicine;* 5: No. 3, 221-228(Jun 1980).

In this report, the left ventricular blood pool of the heart is presented as an image of three dimensions by collecting the data simultaneously with two scintillation cameras from two directions at right angles to one another and processing by a computer system. Our three dimensional procedures, quite different from the conventional two dimensional images, reproduce the cubic structure of the left ventricle. It was confirmed by basic experiments using several phantoms that this three dimensional image reproduced the shape of the object very accurately. The three dimensional images of the left ventricle clearly showed morphological changes and abnormalities in myocardial movement. It is highly valuable in diagnosis because foci of myocardial infarction, akinesis and dyskinesis are clearly detected by this technique. In particular, the fact that the three dimensional images conform well with X-ray cineangiography and ^{201}Tl scanning justifies the value of the clinical application of this technique.

28655 **Assessment of regional blood flow by intravenous injection of 99m-technetium-pertechnetate.** Lindner, P.; Wolf, F.; Schad, N. *European Journal of Nuclear Medicine;* 5: No. 3, 229-235(Jun 1980).

A general method for computation of regional blood flow from time-activity curves obtained after intravenous injection of 99m-Tc-pertechnetate is presented. The method is based on the well-known principle of Meier and Zierler, but, it also considers the dispersion of an intravenously injected activity-bolus as well as the recirculation of the nondiffusible tracer. The problems arising from the use of a nondiffusible indicator concerning the partition coefficient lambda are discussed. This method of blood flow determination is adopted for measurements of cerebral blood flow and some first results are discussed.

28656 **Clinical comparison of three liver scanning agents.** Adams, F.G.; Selim, S.M.; Horton, P.W. *European Journal of Nuclear Medicine;* 5: No. 3, 237-239(Jun 1980).

The biological distributions of sup(99m)Tc-sulphur colloid, sup(99m)Tc-tin colloid and sup(99m)Tc-phytate colloid were quantitatively compared in a randomised trial. All three radiopharmaceuticals gave satisfactory liver images. There is evidence to suggest that the phytate colloid significantly underestimates splenic uptake. The tin colloid was easier to dispense than the sulphur colloid and was found to be the most suitable radiopharmaceutical.

28657 **Use of ^{131}I-19 cholesterol in functional dynamic studies of the adrenals in vivo. Pt. 3.** Magrini, A.; Guerrisi, M.; Pavoni, P.; Concolino, G.; Mango, L. *European Journal of Nuclear Medicine;* 5: No. 3, 247-255(Jun 1980).

Adrenal uptake of ^{131}I-19 cholesterol, administered intravenously, was studied in five normal volunteers and in five patients with various adrenal diseases. Daily counts over the adrenal area and over the lumbar column area (assumed to be representative of blood activity) were performed for 15-20 days after administration of the tracer. Data obtained were analyzed with a three-pool model (two blood pools and one adrenal pool) which enabled us to take into account the influence of extraadrenal cholesterol metabolism on adrenal uptake and to correct the blood activity in the adrenal area more accurately. The dynamic study of adrenal function with the compartimental analysis proposed in the present study provides information not only on the plasma cholesterol metabolic parameters, but also on the adrenal cholesterol uptake and adrenal cholesterol output. Information on plasma cholesterol metabolic parameters is extremely useful because adrenal cholesterol metabolism can be studied in an observation period of less than 30 days, i.e., before commencement of the true clearance curves of cholesterol from the adrenals. From the results obtained it was found that the adrenal output rates give information on the physiology and on the physiopathology of each adrenal. The relative turnover rate, in fact, in all cases of hyperadrenocorticism examined was about 2 to 100 times higher than the maximum value observed in normal subjects. The study proposed seems more specific than those based on the qualitative evaluation of adrenal images or on the simple determination of the maximum percent uptake.

28658 **Clinical comparison of skeletal imaging agents.** Adams, F.G.; Horton, P.W.; Stenhouse, G. *European Journal of Nuclear Medicine;* 5: No. 3, 257-260(Jun 1980).

^{99}sup(m)Tc-methylene diophosphonate from two manufacturers was compared with ^{99}sup(m)Tc-ethane hydroxy diphosphonate in a randomised trial to assess the relative blood clearances and the subsequent image quality. The ^{99}sup(m)Tc-methylene diphosphonate preparations were found to be superior with respect to both blood clearance and subjectively assessed image quality, particularly when the interval between injection and scanning was three hours. Bone/soft tissue ratios did not mirror the highly significant qualitative comparisons of image quality.

28659 **Bone scanning in the diagnosis of acute osteomyelitis.** Nelson, H.T.; Taylor, A. *European Journal of Nuclear Medicine;* 5: No. 3, 267-269(Jun 1980).

Fifty-nine patients with suspected osteomyelitis were referred to the Nuclear Medicine Service for bone scanning during a twelve month period. The bone scan correctly identified abnormal sites in 18 of 19 patients with osteomyelitis (sensitivity of 95%) while the radiograph detected only 6 of 19 (sensitivity of 32%). In this clinical setting, the bone scans and radiographs had specificities of 92% and 89% respectively. Technetium- 99m phosphate radiopharmaceuticals are superior to the previously used isotopes of fluorine and strontium in that they are readily available, can be imaged with conventional instruments, and allow high quality scans to be completed within 4 h. Routine bone scanning should be performed in patients presenting with suspected osteomyelitis and normal radiographs. The scan can be helpful in confirming or excluding the clinical suspicion and can lead to a more rapid institution of appropriate treatment.

28660 **In vivo localization of Ga-citrate in rat liver as determined by cell fractionation with isopycnic rate-zonal ultracentrifugation.** Samezima, K.; Orii, H. *European Journal of Nuclear Medicine;* 5: No. 3, 281-288(Jun 1980).

The in vivo behaviour of Ga-67 citrate was studied, using a rat liver model, and the mechanisms of cellular uptake were investigated by observing the time course of the radionuclide in subcellular liver cell fractions. Modified continuous ultracentrifugation was used to successively fractionate the homogenates according to isopycnic and rate-zonal principles. To collect the cell nuclei, a special technique, which consisited of supplementing the outer sucrose layer with cesium chloride to increase density, was applied to trap nuclei with isopycnic equilibrium. We isolated nuclei, mitchondria, lysosomes and peroxysomes, microsomes, and the cell supernatant in a sufficiently purified state. By this method, the in vivo localization of Ga-67 was studied. At 30 min after intraveneous injection, radioactivity was found mainly in the cell supernatant, the radioactivity peak corresponded to 5 S. However, after 24 h, the radioactivity was localized in the heavier fraction containing lysosomes and heavy endoplasmic reticulum. No intranuclear localization was observed. In spite of the difficulty in completely separating the lysosomal fraction from heavy endoplasmic reticulum, our results suggest the participation of heavy endoplasmic reticulum in gallium localization.

28661 **Cerebrovascular accident and abnormal focus of hyperactivity revealed by dynamic study in scintiangioencephalography.** Planchon, C.A.; Perez, R.; Lebourges, J. *European Journal of Nuclear Medicine;* 5: No. 3, 289-291(Jun 1980).

A 75-year-old female was admitted to the hospital for suspicion of a cerebrovascular accident. An important focus of hyper-

activity was noted during a dynamic study by scintiangioencephalography, consistent with a highly vascular tumor, but corresponding in fact to a focal transitory hyperfusion with accompanying intense neuronal activity.

28662 **Direct subdural scintigraphy.** Keren, G.; Barzilay, Z.; Czerniak, P.; Cohen, B.E. *European Journal of Nuclear Medicine;* **5**: No. 3, 293-297(Jun 1980).

We report a case of pneumococcal meningitis in an 8 weeks old female infant followed by persistent subdural effusion successfully treated by repeated subdural taps. The initial delineation of the subdural effusion, the decrease in size and the disappearance of the fluid were demonstrated by direct subdural scintigraphy (D.S.S.). The literature of pneumoccocal meningitis, its diagnosis, treatment and complications are reviewed, and it is suggested that direct subdural scintigraphy should be employed as a diagnostic aid in the evaluation and follow up of subdural effusions.

28663 **Accumulation of Tc-99m phosphonate complexes in metastatic lesions from colon and lung carcinomas.** Kim, E.E.; Domstad, P.A.; Choy, Y.C.; DeLand, F.H. *European Journal of Nuclear Medicine;* **5**: No. 3, 299-301(Jun 1980).

Cases are presented in which Tc-99m methylene diphosphonate accumulated in a lung metastasis from well differentiated adenocarcinoma of the colon, and in a hepatic metastasis from oat cell carcinoma of the lung. To our knowledge, this is the first report of Tc-99m phosphonate complexes concentrated in a pulmonary metastasis of colonic carcinoma or in a hepatic metastasis of oat cell lung carcinoma. The exact mechanism for this non-osseous uptake of bone scanning agents is still unknown.

28664 **Radioimmunoassay of buprenorphine.** Bartlett, A.J.; Lloyd-Jones, J.G.; Rance, M.J.; Flockhart, I.R.; Dockray, G.J.; Bennett, M.R.D. *European Journal of Clinical Pharmacology;* **18**: No. 4, 339-345(1980).

Antisera to buprenorphine were obtained in rabbits immunised with 3-0-carboxymethylbuprenorphine and N-hemisuccinylnorbuprenorphine conjugated to bovine serum albumin. Using the latter antiserum and tritium labelled buprenorphine a radioimmunoassay having good accuracy and precision was developed for concentrations as low as 50 picograms in 1 ml of plasma. The N-hemisuccinyl antiserum crossreacted with norbuprenorphine, and the 3-0-glucuronide conjugate with the 3-0-carboxy-methyl antiserum. Cross-reactivity of both antisera to other pharmacologically related compounds was negligible. The assay was employed to determine plasma buprenorphine concentration following its parenteral administration to dog and man.

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REFER ALSO TO CITATION(S) 27796, 28562, 28674, 28714, 28737

28665 **Fermentation and anaerobic respiration by Rhodospirillum rubrum and Rhodopseudomonas capsulata.** Schultz, J.E.; Weaver, P.F. (Solar Energy Research Instit., Golden, CO). *Journal of Bacteriology;* **149**: No. 1, 181-190(Jan 1982).

Rhodospirillum rubrum and Rhodopseudomonas capsulata were able to grow anaerobically in the dark either by a strict mixed-acid fermentation of sugars or, in the presence of an appropriate electron acceptor, by an energy-linked anaerobic respiration. Both species fermented fructose without the addition of accessory oxidants, but required the initial presence of bicarbonate before fermentative growth could begin. Major products of R. rubrum fermentation were succinate, acetate, propionate, formate, hydrogen, and carbon dioxide; R. capsulata produced major amounts of lactate, acetate, succinate, hydrogen, and carbon dioxide. R. rubrum and R. capsulata were also capable of growing strictly through anaerobic, respiratory mechanisms. Nonfermentable substrates, such as succinate, malate, or acetate, supported growth only in the presence of an electron acceptor such as dimethyl sulfoxide or trimethylamine oxide. Carbon dioxide and succinate plus dimethyl sulfoxide were produced during growth of R. rubrum and R. capsulata on succinate plus dimethyl sulfoxides. Molar growth yields from cultures grown anaerobically in the dark on fructose plus dimethyl sulfoxide were 3.8 to 4.6 times higher than values obtained from growth on fructose alone and were 56 to 60% of thevalues obtained from aerobic, respiratory growth with fructose. Likewise, molar growth yields from anaerobic, respiratory growth conditions with succinate plus dimethyl sulfoxide were 51 to 54% of the values obtained from aerobic, respiratory growth with succinate. The data indicate that dimethyl sulfoxide or trimethylamine oxide as a terminal oxidant is approximately 33 to 41% as efficient as O_2 in conserving energy through electron transport-linked respiration.

28666 **Comparison of unitrophic and mixotrophic substrate metabolism by an acetate-adapted strain of Methanosarcina barkeri.** Krzycki, J.A.; Wolkin, R.H.; Zeikus, J.G. (University of Wisconsin, Madison). *Journal of Bacteriology;* **149**: No. 1, 247(Jan 1982).

We examined the unitrophic metabolism of acetate and methanol individually and the mixotrophic utilization of these compounds by using detailed ^{14}C-labeled tracer studies in a strain of Methanosarcina barkeri adapted to grow on acetate as the sole carbon and energy source. The substrate consumption rate and methane production rate were significantly lower on acetate alone than during the unitrophic or mixotrophic metabolism of methanol. Cell yields (in grams per mole of substrate) were identical during exponential growth on acetate and exponential growth on methanol. During unitrophic metabolism of acetate, the methyl moiety accounted for the majority of the CH_4 produced, but 14% of the CO_2 generated originated from the methyl moiety. This correlated with the concurrent reduction of equivalent amounts of the C-1 of acetate to CH_4. $^{14}CH_4$ was also produced from added $^{14}CO_2$, although to a lesser extent than from reduction of the C-1 of acetate. During mixotrophic metabolism, methanol and acetate were catabolized simultaneously. The rates of $^{14}CH_4$ and $^{14}CO_2$ generation from [2-^{14}C]acetate were logarithmic and higher in mixotrophic than in unitrophic cultures at substrate concentrations of 50 mM. A comparison of the oxidoreductase activities in cell extracts of the acetate-adapted strain grown on acetate and of strain MS grown on methanol or on H_2 plus CO_2 indicated that the pyruvate, α-ketoglutarate, and isocitrate dehydrogenase activities remained constant, whereas the CO dehydrogenase activity was significantly higher (5,000 nmol/min per mg of protein) in the acetate-adapted strain. These results suggested that a significant intramolecular redox pathway is possible for the generation of CH_4 from acetate, that energy metabolism from acetate by M. barkeri is not catabolite repressed by methanol, and that the acetate-adapted strain is a metabolic mutant with depressed CO dehydrogenase activity.

28667 **Carbon monoxide metabolism of the methylotrophic acidogen Butyribacterium methylotrophicum.** Lynd, L.; Kerby, R.; Zeikus, J.G. (University of Wisconsin, Madison). *Journal of Bacteriology;* **149**: No. 1, 255-263(Jan 1982). Contract AC02-80ER10705.

The Marburg strain of Butyribacterium methylotrophicum did not grow on CO alone but did consume CO during growth on a variety of substrates in the presence of a 100% CO gas phase. We selected a strain (the CO strain) that grew vigorously on CO alone. The ability of the CO strain to grow on CO was stable through multiple transfers in the absence of CO. CO dehydrogenase activity was lower in the CO strain grown on CO (13.3 μmol/min per mg of protein); thus, the levels of this enzyme did not explain the growth on CO. CO was dissimilated to acetate and CO_2 with the following stoichiometry: 4 CO $\rightarrow$ 2.17 CO_2 + 0.74 acetate. We observed a growth rate of 0.05 h^{-1}, a final optical density of 660 nm of 0.8, and a cell yield of 3.0 g of cells per mol of CO during growth of the CO strain. Growing cultures of the CO strain displayed a K/sub s/ for CO of 28 to 56 μM. The apparent thermodynamic efficiency of cell synthesis from CO was 57%. Energetic and biochemical aspects of CO metabolism are described.

28668 **Antibody analysis of relationships among methanogenic bacteria.** de Macario, E.C.; Wolin, M.J.; Macario, A.J.L. (New York State Dept. of Health, Albany). *Journal of Bacteriology;* **149**: No. 1, 316-319(Jan 1982).

A bank of antisera to the majority of methanogenic bacteria is now available. Three antibody probes, R, S, and T, were derived from each antiserum in the bank and used for analysis of antigenic relatedness among methanogens by immunofluorescence. The T

probe reacted only with the immunizing (or homologous) strain, the S probe gave strong cross-reactions with strains of the same species, and the R probe revealed some interspecies relationships. The results were confirmed and extended by enzyme immunoassays and standard serological methods involving serial dilution analysis, cross-adsorptions, and the use of reference strains. The immunological methods and standardized antibody probes are useful for rapid identification of methanogens and measurements of antigenic relationships which aid in classification of these bacteria.

28669 **Specific antisera and immunological procedures for characterization of methanogenic bacteria.** de Macario, E.C.; Macario, A.J.L.; Wolin, M.J. (New York State Department of Health, Albany). *Journal of Bacteriology;* **149**: No. 1, 320-328(Jan 1982).

Specific antisera were raised in rabbits to 19 methanogenic bacteria representing the species available in pure culture at the present time. The antisera were characterized, labeled, and organized in a bank to serve as a source of material for preparation of antibody probes and thus provide standardized reagents for immunological analysis of methanogens. An indirect immunofluorescence procedure was standardized for optimal staining of homologous and heterologous bacterial strains. Two immunoenzymatic assays were developed: (i) a simple slide assay, useful for rapid antibody detection in small samples, antibody titrations, and disclosure of cross-reactions among methanogens, and (ii) a quantitative method. The latter is useful for quantification of antigenic relatedness. Procedural details were developed to obtain optimal bacterial preparations for use as immunogens to raise antibodies in vivo, and as antigens for antibody assay in vitro.

5508 Morphology

28670 **Vitelline envelope, chorion, and micropyle of Fundulus heteroclitus eggs.** Dumont, J.N. (Oak Ridge National Lab., TN); Brummet, A.R. *Gamete Research;* **3**: 25-44(1980). Contract W-7405-ENG-26.

The architecture and transformation of the vitelline envelope of the developing oocyte into the chorion of the mature egg of Fundulus heteroclitus have been examined by scanning and transmission electron microscopy. The mature vitelline envelope is structurally complex and consists of about nine strata. The envelope is penetrated by pore canals that contain microvilli arising from the oocyte and macrovilli from follicle cells. During the envelope's transformation into the chorion, the pore canals are lost and the envelope becomes more fibrous and compact and its stratified nature less apparent. The micropyle, or pore, through which the sperm gains access to the enclosed egg is located at the bottom of a small funnel-shaped depression in the envelope. Internally, the micropyle opens on the apex of a cone-like elevation of the chorion. During the development of the envelope, structured chorionic fibrils, the components of which are presumed to be synthesized by the follicle cells, become attached to its surface. These chorionic fibrils are thought to aid in the attachment of the egg to the substratum and perhaps to help prevent water loss during low tides when the egg may be exposed.

5509 Pathology

REFER ALSO TO CITATION(S) 28703, 28732

5510 Physiological Systems

REFER ALSO TO CITATION(S) 28557, 28560, 28674, 28703, 28719

28671 **Changes in blood-brain permeability resulting from d-amphetamine, 6-hydroxydopamine and pimozide measured by a new technique.** Braun, U.; Graun, G.; Sargent, T. III. (Univ. of California, Berkeley). *Experientia;* **36**: 207-209(1980).

A new technique is described for measurement of diffusion across the blood-brain barrier using intraventricularly administered ^{68}Ga-EDTA, and determining loss from the brain with a scintillation camera. Repeated injections via permanent cannulas showed that the diffusion half-time was reduced to 50% of control values after intraventricular d-amphetamine and 6-hydroxydopamine; pimozide had no effect.

5520 Public Health

REFER ALSO TO CITATION(S) 28479, 28483, 28534, 28702

5530 Agriculture And Food Technology

REFER ALSO TO CITATION(S) 28564

56 BIOMEDICAL SCIENCES, APPLIED STUDIES

5601 Radiation Effects

REFER ALSO TO CITATION(S) 27740, 27741, 27751, 28453, 28515, 28529, 28529, 28548, 28642, 28652, 28653, 28657

28672 **(AD-A—104330/6) Control of vectors through interference with normal processes of insect physiology, reproduction and behavior. Final report 1968-1976.** Schermeister, L.J.; Sandal, P.C.; Frye, R.D. (North Dakota State Univ., Fargo (USA). Dept. of Pharmacognosy). Apr 1978. 191p. NTIS, PC A09/MF A01.

Over 3000 crude water, alcohol and pet-ether plant part extracts were bioassayed with mosquitoes and Drosophila in an effort to identify agents which specifically interfere with insect metamorphosis, and which could provide environmentally safe insect control. About 10% of the extracts modified metamorphosis. Juvenile hormone type activity was noted in some extracts. Preliminary fractionation of promising extracts revealed fractions-bioassay results similar to that of the crude extracts. Exact nature of active fractions was not fully determined; however, flavanoids, alkaloids, and glycosides were suggested. Other agents including teratogens, hormones, and chemosterilant apholate, and gamma-radiation showed promise as potential vector control agents. Wing movements, sound patterns, and population dynamics of mosquitoes were studied as a step toward developing insect behavior and confusion and surveillance techniques. Transmission electron microscopy revealed the morphological nature of the cuticle layer of mosquito but additional studies are needed to understand chemical penetration of the cuticle. The septum of mosquito testes was found to be layered and surrounded by mitochondria. Ovaries were cultured on artificial media and a stain for neurosecretory activity was developed. Synthesis of Difluroperazine dihydro chloride and position labeling was achieved.

28673 **(LBL—13444) Controversial issues confronting the BEIR III committee: implications for radiation protection.** Fabrikant, J.I. (Lawrence Berkeley Lab., CA (USA); California Univ., San Francisco (USA). School of Medicine). May 1981. Contract W-7405-ENG-48. 51p. (CONF-8105131—1). NTIS, PC A04/MF A01. Order Number DE82002966.

From 13. annual national conference on radiation control; Little Rock, AR, USA (2 May 1981).

This paper reviews the state-of-the-art for conducting risk assessment studies, especially known and unknown factors relative to radioinduced cancer or other diseases, sources of scientific and epidemiological data, dose-response models used, and uncertainties which limit precision of estimation of excess radiation risks. These are related to decision making for radiation protection policy. (PSB)

28674 **(PB—82-106774) Annual report of Radiobiological Institute TNO, experimental gerontology (Institute for TNO), primate center TNO (rep), 1980.** (Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, The Hague (Netherlands)). 1980. 283p. NTIS, PC A13/MF A01.

The annual report contains sections on radiation physics; radiobiology; hematology; leukemia research; tumor induction and tumor biology; experimental tumor therapy; gerontology; immunology; transplantation and immunogenetics; microbiology and gnotobiology; ethology; and techniques and animals.

28675 (PNL—4100-Pt.1, pp 61-71) **Inhaled plutonium oxide in dogs.** Park, J.F. Feb 1982. NTIS, PC A10/MF A01.

In Pacific Northwest Laboratory annual report for 1981 to the DOE Office of Energy Research. Part 1. Biomedical sciences.

This project is concerned with long-term experiments to determine the lifespan dose-effect relationships of inhaled $^{239}PuO_2$ and $^{238}PuO_2$ in beagles. Beagle dogs given a single exposure to $^{239}PuO_2$ or $^{238}PuO_2$ aerosols are being observed for lifespan dose-effect relationships. The ^{239}Pu body burden of the nine dogs that died of pulmonary-fibrosis-induced respiratory insufficiency during the first 3 yr after exposure was 1 to 12μCi. Nineteen of the dogs exposed to ^{238}Pu haved died during the first 7-1/2 yr after exposure due to bone and/or lung tumors; their body burdens at death ranged from 0.7 to 10μCi. Chronic lymphopenia was the earliest observed effect after inhalation of $^{239}PuO_2$ or $^{238}PuO_2$.

28676 (PNL—4100-Pt.1, pp 73-76) **Inhaled plutonium nitrate in dogs.** Dagle, G.E. Feb 1982. NTIS, PC A10/MF A01.

In Pacific Northwest Laboratory annual report for 1981 to the DOE Office of Energy Research. Part 1. Biomedical sciences.

The major objective of this project is to determine dose-effect relationships of inhaled plutonium nitrate in dogs to aid in the prediction of health effects of accidental exposure in man. For lifespan dose-effect studies, beagle dogs were given a single inhalation exposure to $^{239}Pu(NO_3)_4$, in 1976 and 1977. The earliest biological effect was on the hematopoietic system; as described in previous Annual Reports, lymphopenia and neutropenia occurred at the two highest dose levels. Radiation pneumonitis, lung cancer, and bone cancer have been observed at the highest dose levels.

28677 (PNL—4100-Pt.1, pp 77-83) **Inhaled americium dioxide.** Park, J.F. Feb 1982. NTIS, PC A10/MF A01.

In Pacific Northwest Laboratory annual report for 1981 to the DOE Office of Energy Research. Part 1. Biomedical sciences.

This project includes experiments to determine the effects of Zn-DTPA therapy on the retention, translocation and biological effects of inhaled $^{241}AmO_2$. Beagle dogs that received inhalation exposure to $^{241}AmO_2$ developed leukopenia, clincial chemistry changes associated with hepatocellular damage, and were euthanized due to respiratory insufficiency caused by radiation pneumonitis 120 to 131 days after pulmonary deposition of 22 to 65 μCi ^{241}Am. Another group of dogs that received inhalation exposure to $^{241}AmO_2$ and were treated daily with Zn-DTPA had initial pulmonary deposition of 19 to 26 μCi ^{241}Am. These dogs did not develop respiratory insufficiency, and hematologic and clinical chemistry changes were less severe than in the non-DTPA-treated dogs.

28678 (PNL—4100-Pt.1, pp 85-88) **Inhaled transuranics in rodents.** Sanders, C.L. Feb 1982. NTIS, PC A10/MF A01.

In Pacific Northwest Laboratory annual report for 1981 to the DOE Office of Energy Research. Part 1. Biomedical sciences.

Pulmonary and skeletal scarcinogenesis following inhalation of transuranic oxides is dependent upon spatial and temporal alpha dose-distribution patterns in the target tissues. Inhaled $^{241}AmO_2$ behaves similarly to inhaled $^{244}CmO_2$, resulting in lung and bone tumor incidences similar to those with $^{244}CmO_2$. Fractionated $^{244}CmO_2$ inhalation exposures, unlike fractionated exposures to inhaled $^{239}PuO_2$, increase the yield of lung and bone tumors. Immunological studies have not demonstrated a peripheral-blood lymphopenia, but have shown an altered humoral immune response. Vitamin C given to rats following inhalation of $^{239}PuO_2$ resulted in a nonsignificant decrease in lung-tumor incidence. An in vitro study of the radioresistance of alveolar macrophages showed that a dose of 10,000 rad is required to significantly reduce their bactericidal capability.

28679 (PNL—4100-Pt.1, pp 89-91) **Low level $^{239}PuO_2$ life-span studies .** Sanders, C.L. Feb 1982. NTIS, PC A10/MF A01.

In Pacific Northwest Laboratory annual report for 1981 to the DOE Office of Energy Research. Part 1. Biomedical Sciences.

The purpose of this projet is to determine the dose-response curve for lung-tumor incidence in rats following inhalation of $^{239}PuO_2$ at levels producing a lifespan radiation dose of 2 to 100 rad. In preliminary studies, rats were intratracheally instilled with, or inhaled ^{169}Yb-$^{239}PuO_2$ or ^{169}Yb-Yb_2O_3 particles. Whole-body, excreta and tissue levels of ^{169}Yb were determined by external gamma counting; ^{239}Pu levels were determined radiochemically by scintillation counting. It was found that ^{169}Yb dissociated from $^{239}PuO_2$ and was cleared more rapidly from the lung and the whole body. Despite this fact, however, whole-body counts performed at 7 days after exposure to ^{169}Yb-$^{239}PuO_2$ gave a reproducible measure of the ^{239}Pu lung burden.

28680 (PNL—4100-Pt.1, pp 93-94) **Toxicology of plutonium-sodium.** Hackett, P.L. Feb 1982. NTIS, PC A10/MF A01.

In Pacific Northwest Laboratory annual report for 1981 to the DOE Office of Energy Research. Part 1. Biomedical sciences.

Scenarios for liquid-metal fast breeder reactor (LMFBR) accidents predict the loss of sodium coolant, with subsequent core melt-down and release of mixed sodium-fuel aerosols [Na-$(PuU)O_2$] into the environment. Studies in other laboratories demonstrated that mixed aerosols of Na_2O-PuO_2 were more readily transported from the lung than PuO_2 aerosols. We therefore devised a continuous aerosol-generating system for animal exposures in which laser-generated fuel aerosols were swept through sodium vapor to form sodium-fuel aerosols. These fuel and sodium-fuel aerosols were compared with regard to their physicochemical properties and their biological behavior following inhalation studies in rats and dogs.

28681 (PNL—4100-Pt.1, pp 95-97) **Cigarette smoke and plutonium.** Filipy, R.E. Feb 1982. NTIS, PC A10/MF A01.

In Pacific Northwest Laboratory annual report for 1981 to the DOE Office of Energy Research. Part 1. Biomedical sciences.

The major objective of this project is to obtain experimental data that are directly applicable to resolving the question of whether cigarette smokers are at greater risk than nonsmokers to potential health effects of inhaled plutonium. Progress was made on two fronts during the past year. The autoradiographic technique developed from detection of plutonium on the interior surface of pulmonary airways (Annual Report, 1978) has been adapted to routine use in examining tracheas and bronchi of rats. Also, dogs exposed to cigarette smoke for over a year after inhalation of plutonium were killed and necropsied.

28682 (PNL—4100-Pt.1, pp 105-106) **Toxicology of Krypton-85.** Ballou, J.E. Feb 1982. NTIS, PC A10/MF A01.

In Pacific Northwest Laboratory annual report for 1981 to the DOE Office of Energy Research. Part 1. Biomedical sciences.

The purpose of this research is to obtain biological data to supplement earlier evaluations of the hazards of ^{85}Kr exposure. The studies include both short-term and chronic exposure of rats, dogs and sheep to determine tissue distribution and retention kinetics for metabolic modeling purposes. Dose-effect studies in rats exposed acutely as newborns or chronically for most of their life span are included to identify tissues at risk and determine tumorigenic potency.

28683 (PNL—4100-Pt.1, pp 107-111) **Toxicity of thorium cycle nuclides.** Ballou, J.E. Feb 1982. NTIS, PC A10/MF A01.

In Pacific Northwest Laboratory annual report for 1981 to the DOE Office of Energy Research. Part 1. Biomedical sciences.

The purpose of this project is to investigate the biological hazards associated with uranium-thorium breeder fuels and fuel recycle process solutions. Initial studies will emphasize the metabolism and long-term biological effects of inhaled ^{233}U-^{232}U nitrate and oxide fuel materials and of ^{231}Pa, a major, long-lived, radioactive waste product.

28684 (PNL—4100-Pt.1, pp 113-117) **Fetal and juvenile radiotoxicity.** Sikov, M.R. Feb 1982. NTIS, PC A10/MF A01.

In Pacific Northwest Laboratory annual report for 1981 to the DOE Office of Energy Research. Part 1. Biomedical sciences.

This project is directed at obtaining detailed comparative information on the deposition, distribution, retention, and toxicity of radionuclides in the prenatal and juvenile mammal. Because quantitative data cannot necessarily be extrapolated to man, our emphasis is directed toward establishing patterns, phenomenologic interactions, and relationships which will be useful in determining appropriate exposure levels for the rapidly growing infant or child, and for pregnant women. Recent results demonstrated that injection of pregnant rats with ^{238}Pu had the greatest effect on longevity and bone-tumor incidence of the offspring when exposure occurred at 19 days of gestation (dg); less effect at 15 dg and the least effect at 9 dg. Ongoing distribution studies are providing data which confirm our tentative explanation that marked variations in the anatomic distributions of bone tumors, with age at the time of injection, were attributable to age-related differences in ^{239}Pu microdosimetry and concentrations among skeletal components. Other studies, using a placental perfusion technique, have demonstrated that intravenous injection of ^{239}Pu in pregnant guinea pigs leads to a marked decrease in maternal blood flow to the placenta.

28685 (PNL—4100-Pt.1, pp 119-122) **Gut-related radionuclide studies.** Sullivan, M.F. Feb 1982. NTIS, PC A10/MF A01.

In Pacific Northwest Laboratory annual report for 1981 to the DOE Office of Energy Research. Part 1. Biomedical sciences.

This project is concerned with the behavior of radioactive materials that may be ingested as a consequence of a reactor accident, unavoidable occupational exposure, or after release to the environment and incorporation into the food chain. Current emphasis is directed toward evaluating hazards from ingested actinides as a function of animal age, species, nutrition, and diet, or chemicophysical state of the actinide. Recent observations indicate that the influence of chemical form on plutonium absorption observed at high mass levels does not occur at low mass concentrations. For example, at doses of 0.6 μg/kg there was no difference between absorption of the carbonate, citrate or nitrate forms of plutonium. However, at 1.5 mg/kg, the citrate was absorbed in quantities 30 times higher than the nitrate. The opposite effect occurred for neptunium GI absorption. Furthermore, it was demonstrated that materials such as citrus fruit juices and calcium, as well as drugs that affect GI function (such as aspirin and DTPA), markedly influence GI absorption of plutonium. Such studies provide evidence that diet and nutritional state should be considered in establishing safe limits for radionuclides that may be ingested.

28686 (PNL—4100-Pt.1, pp 125) **Statistical health-effects study.** Gilbert, E.S. Feb 1982. NTIS, PC A10/MF A01.

In Pacific Northwest Laboratory annual report for 1981 to the DOE Office of Energy Research. Part 1. Biomedical sciences.

The main purpose of this program is to analyze the mortality of Hanford workers and to determine the effects of radiation exposure in this population. A secondary purpose is to improve methodology for assessing health effects of chronic low-level exposure to harmful agents or substances, particularly in an occupational setting. In the past year we have updated our analyses, submitted papers for publication in the two areas of methodological research, and have interacted with Hanford Environmental Health Foundation staff to improve data collection procedures.

28687 (PNL—4100-Pt.1, pp 149-164) **Dose-effect studies with inhaled plutonium in beagles.** Feb 1982. NTIS, PC A10/MF A01.

In Pacific Northwest Laboratory annual report for 1981 to the DOE Office of Energy Research. Part 1. Biomedical sciences.

Data are presented for all dogs employed in current life-span dose effect studies with inhaled $^{239}PuO_2$, and ^{239}Pu nitrate. Information is presented on the estimated initial alveolar deposition, based on external thorax counts and on estimated lung weights at time of exposure. Information is also provided on the current interpretation of the most prominent clinical-pathological features associated with the death of animals.

28688 (PNL—4100-Pt.4, pp 41-50) **Modeling and cellular studies.** Feb 1982. NTIS, PC A06/MF A01.

In Pacific Northwest Laboratory annual report for 1981 to the DOE Office of Energy Research. Part 4. Physical sciences.

Testing the applicability of mathematical models with carefully designed experiments is a powerful tool in the investigations of the effects of ionizing radiation on cells. The modeling and cellular studies complement each other, for modeling provides guidance for designing critical experiments which must provide definitive results, while the experiments themselves provide new input to the model. Based on previous experimental results the model for the accumulation of damage in Chlamydomonas reinhardi has been extended to include various multiple two-event combinations. Split dose survival experiments have shown that models tested to date predict most but not all the observed behavior. Stationary-phase mammalian cells, required for tests of other aspects of the model, have been shown to be at different points in the cell cycle depending on how they were forced to stop proliferating. These cultures also demonstrate different capacities for repair of sublethal radiation damage.

28689 (PNL—4100-Pt.4, pp 55-59) **Microdosimetry of internal sources.** Feb 1982. NTIS, PC A06/MF A01.

In Pacific Northwest Laboratory annual report for 1981 to the DOE Office of Energy Research. Part 4. Physical sciences.

The purpose of this study is to develop practical methods for calculating microdosimetric distributions of plutonium or other alpha-emitting elements that are deposited, especially as particulates, in soft tissue and lung tissue. This study will aid the correlation and extrapolation of radiation effects measured at different levels of exposure and in different species.

28690 (PNL—4100-Pt.4, pp 61-63) **Dosimetry of internal emitters.** Feb 1982. NTIS, PC A06/MF A01.

In Pacific Northwest Laboratory annual report for 1981 to the DOE Office of Energy Research. Part 4. Physical sciences.

The Dosimetry of Internal Emitter Program endeavors to refine the correlation between radiation dose and observed biological effects. The program is presently engaged in the development of studies that will demonstrate the applicability of microdosimetry models developed under the Microdosimetry of Internal Sources Program. The program also provides guidance and assistance to Pacific Northwest Laboratory's Biology Department in the dosimetric analysis of internally deposited radionuclides. This report deals with alpha particle dosimetry plutonium 239 inhalation, and in vitro studies of chromosomal observations.

28691 **Relevance of animal experimental results for the assessment of radiation genetic risks in man.** Stephan, G. (Bundesgesundheitsamt, Neuherberg (Germany, F.R.). Inst. fuer Strahlenhygiene). *Bundesgesundheitsblatt;* **24**: No. 4/5, 74-77(27 Feb 1981). (In German).

No suitable data are available from man for the quantitative assessment of genetic radiation risk. Therefore, the results from experiments on animals must be utilized. Two hypotheses are presented here in drawing analogical conclusions from one species to another. Although the extrapolation of results from animal experiments remains an open question, the use of experimental results from mice seems to be justified for an assessment of the genetic radiation risk in man.

28692 **Simultaneous measurements of ^{59}Fe and ^{51}Cr in iron absorption studies using a whole-body scanner with mobile shielding.** Marx, J.J.M.; van den Beld, R.B.; van Dongen, R.; Strackee, L.H. *Nuclear-Medizin (Stuttgart);* **19**: No. 3, 140-145(Jul 1980).

A whole-body scanner is described with a mobile shadow shield which affords a considerable reduction in space. The scanner has two NaI(Tl) scintillation crystals of 4 x 6 , placed at opposite sites of the subject. Background radiation, efficiency and geometric qualities made the scanner very useful for clinical whole-body counting. The equipment was used in iron absorption studies using a double isotope technique with ^{59}Fe and ^{51}Cr. After ingestion of an oral test dose total body kinetics of ^{59}Fe and ^{51}Cr was followed up to 60 days in 4 volunteers. Between days 3 and 10 the ^{51}Cr, which was used as an non-absorbable indicator, had left the body completely. The ^{59}Fe reached a constant value not before day 10, indicating that iron retention cannot be measured before that time.

From repeated measurement of ^{59}Fe and ^{51}Cr directly after ingestion until the first defaecation it could be deduced that the coefficient of variation for ^{59}Fe was less than 1.5% with a scanning time of 600 sec. and for ^{51}Cr less than 5%. Extreme variations in geometry, such as measurement of the activity in a beaker and of the same amount after ingestion in the body, yielded practically the same value for ^{59}Fe. The double isotope technique made it possible to measure not only iron retention but also mucosal uptake and mucosal transfer of iron. It is pointed out that measurement of the last two parameters of iron absorption is not possible in patients with serious obstipation or with very low muscosal uptake values.

28693 **Effects of X-irradiation in G_1 and G_2 on Bloom's syndrome and normal chromosomes.** Meyer Kuhn, E. (Wisconsin Univ., Madison (USA). Dept. of Medical Genetics). *Humangenetik;* **54**: 335-341(1980).

The X-ray sensitivity of chromosomes from a Bloom's syndrome patient and a normal control was compared in G_1 and G_2. There was no significant difference in the number of aberrations induced by irradiation in G_1. An increased sensitivity of the BS chromosomes was found in G_2. The frequency of mitotic chiasmata in the BS cells was not increased by the G_2-irradiation, even though the frequency of chromatid translocations was much increased. This provides further evidence for the fundamental difference of these two phenomena. Evidence from the types of aberrations induced suggests that there is no appreciably increased frequency of pairing of homologous chromosomes in the BS cells over that in normal cells.

5602 Thermal Effects

28694 **(PB—81-154080) Evaluation of C.P. Crane Generating Station thermal discharge effects on the finfish community, summer 1980. Final report.** (Texas Instruments, Inc., Dallas (USA)). Jan 1981. 66p. NTIS, PC A04/MF A01.

The objective of this study was to verify if patterns of abundance observed during Summer, 1980 reflected response to the thermal discharge of the power plant or if they might be attributed to other factors. Fish were collected by both trawling and gill nets at seven stations. Results indicated that the patterns previously attributed to thermal effects may be better explained by habitat preference.

5603 Chemicals Metabolism And Toxicity

REFER ALSO TO CITATION(S) 27659, 27801, 28456, 28461, 28479, 28482, 28495, 28506, 28509, 28510, 28522, 28543, 28543, 28543, 28544, 28544, 28554, 28672

28695 **(FWS/OBS—80/26) Biological evaluation of environmental impacts.** (Council on Environmental Quality, Washington, DC (USA)). Jun 1980. 242p. (CONF-760656—). NTIS, PC A11/MF A01.

From Symposium on biological evaluation of environmental impact; New Orleans, LA, USA (2 Jun 1976).

The role of ecological science in evaluating the biological significance of environmental impacts and in transmitting meaningful results to decision makers in the impact assessment process is examined.

28696 (FWS/OBS—80/26, pp 25-32) **Assessment of ecological damage: Consensus.** Buffington, J.D.; Sharma, R.K.; McFadden, J.T. (Michigan Univ., Ann Arbor). Jun 1980. NTIS, PC A11/MF A01.

From Symposium on biological evaluation of environmental impact; New Orleans, LA, USA (2 Jun 1976).

Problems in defining what constitutes 'biological significance' of environmental impacts are addressed. The quality of collected information, time frame and spatial constraints, the role of statistics, collection methodologies, and simulation models are discussed. It is concluded that an impact is significant if it results in a change that is measurable in a well designed sampling program, and if it persists or is expected to persist more than several years.

28697 (FWS/OBS—80/26, pp 33-39) **Guidelines for ecological evaluation.** Hinckley, A.D. Jun 1980. NTIS, PC A11/MF A01.

From Symposium on biological evaluation of environmental impact; New Orleans, LA, USA (2 Jun 1976).

The principles and methods of ecological analysis are discussed. Environment modeling, natural changes in ecosystems, technological impacts on ecosystems, and the effects of ecological changes on human health and welfare are addressed.

28698 (FWS/OBS—80/26, pp 66-72) **Evaluation of chronic and sublethal toxic effects in the assessment of aquatic environmental impact.** Brungs, W.A. Jun 1980. NTIS, PC A11/MF A01.

From Symposium on biological evaluation of environmental impact; New Orleans, LA, USA (2 Jun 1976).

It is noted that sublethal and chronic toxicity data from field and laboratory studies are available for direct and indirect effects of a wide variety of toxic materials. For proposed discharges or operations, these data are necessary in order to predict effects that might result from subsequent practices. For existing discharges these data are useful for predictive purposes and these calculated effects could be compared to ecological data generated during site specific studies.

28699 (FWS/OBS—80/26, pp 123-128) **Evaluating impacts upon endangered or threatened species.** Jun 1980. NTIS, PC A11/MF A01.

From Symposium on biological evaluation of environmental impact; New Orleans, LA, USA (2 Jun 1976).

The following terms are described in detail: endangered species threatened species and critical habitats. The Endangered Species Act of 1973 (Public Law 93-205) is assessed in terms of environmental impact.

28700 (FWS/OBS—80/26, pp 129-132) **Evaluating impacts on endangered and threatened flora.** Avensu, E.S. Jun 1980. NTIS, PC A11/MF A01.

From Symposium on biological evaluation of environmental impact; New Orleans, LA, USA (2 Jun 1976).

The Report on Endangered and Threatened Plant Species of the United States is analyzed. It is proposed that environmental impact statements concerning land use and alteration include a detailed vegetational inventory.

28701 **(PB—81-154064) Remote sensing of sulfur dioxide effects on vegetation: spectroradiometry.** Sapp, C.D. (Tennessee Valley Authority, Muscle Shoals, AL (USA). Office of Natural Resources). Sep 1980. 54p. NTIS, PC A04/MF A01.

Remote measurements of spectral reflectance were made in a laboratory to study sulfur dioxide (SO_2) effects on the foliage of soybean (Glycine max (L.) Merr.) and winter wheat (Triticum aestivum) plants. The relationship between spectral reflectance and foliar injury from SO_2 was analyzed by separating injury into its components--chlorosis and necrosis--and reflectance into bands within the visible and near-infrared spectra. Results indicate that, for winter wheat, total visible reflectance as well as individual wavelength bands could be used to distinguish the SO_2 effects. Three classes of chlorosis and four classes of necrosis, based on severity, could be distinguished by their visible reflectance characteristics. These results indicate that remote sensors that measure visible reflectance may be able to distinguish moderate to severe injury to wheat from low altitudes. Scans of soybeans provided less positive results. There was no statistically significant (alpha = 0.05) difference among the means of blue, green, red, or near-infrared reflectance or the IR/R ratio when unaffected and chlorotic soybean classes were compared. However, significant (alpha = 0.05) differences in the means of green, red, and near-infrared reflectance (but not blue and the IR/R ratio) were found when unaffected and moderately to severely necrotic soybean classes were compared. Evidently, unless the SO_2 injury to soybeans involves necrosis, reflectance-measuring remote sensors are not likely to detect it from even a low-flying (approx. 500 m above ground level) airborne platform. The necrosis symptom is generally associated with severe

levels of foliar injury, whereas chlorosis usually predominates at moderate and light levels.

28702 **(PB—82-114265) Health effects of carbon monoxide and ozone. Technical report.** (Environmental Protection Agency, Ann Arbor, MI (USA). Inspection and Maintenance Staff). Jul 1981. 20p. NTIS, PC A02/MF A01.

The purpose of this report is to summarize the information known about the health effects of carbon monoxide (CO) and ozone (O3), and how that information is used by EPA to set National Ambient Air Quality Standards (NAAQS's). An additional purpose of this report is to discuss the sources most likely to contribute to high levels of CO and O3 and how EPA control programs will reduce emissions from these sources in the future. For ease in reading, all of the information in this report is presented in question and answer format.

28703 **(PB—82-115148) Effects of ozone inhalation during exercise on selected heart disease patients. Report for 1979-80.** Superko, H.R.; Adams, W.C.; Webb, P.A. (California Univ., Davis (USA). Human Performance Lab.). Mar 1981. 54p. NTIS, PC A04/MF A01.

Heart patients are considered at greater risk during episodes of significant oxidant pollution and, although there are no quantitative laboratory data available, are advised to curtail physical activity. In this investigation, six male volunteers, ages 46-64 years, with clinically documented coronary artery disease and well defined symptomatic angina pectoris threshold on physical exertion, served as subjects. Each patient was exposed on three occasions for 40 minutes to either filtered air or ozone at concentrations of 0.20 or 0.30 ppm while walking on a treadmill at workloads simulating their regularly prescribed symptom limited exercise training regimen. Standard pulmonary function tests and periodic observations of exercise ventilation, respiratory metabolism, electrocardiographic changes, hemodynamic response, and clinical signs and symptoms were noted. Analysis of variance revealed that none of the patients' physiologic responses to ozone exposure were statistically significant. Furthermore, neither onset of angina pain or ischemic changes were related to ozone exposure in a dose dependent fashion. Hence, the patients not only failed to exhibit any unexpected cardiovascular strain while exposed to ozone, but also evidenced no significant pulmonary function impairment or exercise ventilatory pattern alteration as has been observed in clinically normal subjects exercising at similar ozone concentration levels.

28704 **(PB—82-116062) Shrimp and redfish studies, bryan mound brine disposal site off Freeport, Texas, 1979-1981. Volume IV. Interview sampling survey of shrimp catch and effort. Technical memo.** Johnson, M.F. (National Marine Fisheries Service, Galveston, TX (USA). Galveston Lab.; Department of Energy, Washington, DC (USA)). Jun 1981. 66p. NTIS, PC A04/MF A01.

An interview sampling survey of shrimp catch and fishing effort was conducted at specified ports along the Texas coast to strengthen the information base required to determine the effect of the disposal of brine from the Bryan Mound salt dome off Freeport, Texas on commercial brown shrimp (Penaeus aztecus) and white shrimp (Penaeus setiferus) populations in the Gulf of Mexico. The data recorded included port number, vessel name, official vessel number, shrimp dealer number, date of landing, area fished, depth of capture, days fished, and pounds of shrimp caught by species and size categories.

28705 **(PB—82-128018) Summary of EPA and other programs on the potential carcinogenicity of diesel exhaust.** Carey, P.M. (Environmental Protection Agency, Ann Arbor, MI (USA)). Aug 1981. 63p. NTIS, PC A04/MF A01.

Much research has been performed to evaluate the health effects associated with exposure to Diesel emissions. The research performed falls into five general areas: mutagenicity, carcinogenicity, non-genetic effects, characterization, and epidemiology. EPA is conducting a massive research program that includes studies in each area. Since epidemiological data for Diesel emissions are limited, a major portion of EPA's research effort involves determining the relative mutagenic and carcinogenic potency of Diesel emissions compared to potencies of comparative emissions for which epidemiological data are available. EPA will use the results of these studies with epidemiological data for the comparative sources to assess the human health risk associated with exposure to Diesel emissions.

28706 (PNL—4100-Pt.1, pp 5-10) **Solvent refined coal biostudies.** Mahlum, D.D. Feb 1982. NTIS, PC A10/MF A01.

In Pacific Northwest Laboratory annual report for 1981 to the DOE Office of Energy Research. Part 1. Biomedical sciences.

This project has examined the toxicologic properties of a number of SRC-derived materials. Results obtained from studies with mammalian cell culture, the initiation-promotion assay, from inhalation studies, and from efforts at establishing the dosimetric basis from some of the results produced by components of coal-derived materials will be described.

28707 (PNL—4100-Pt.1, pp 11-14) **Health effects of synthetic fuels.** Renne, R.A. Feb 1982. NTIS, PC A10/MF A01.

In Pacific Northwest Laboratory annual report for 1981 to the DOE Office of Energy Research. Part 1. Biomedical sciences.

The purpose of this project is to study the potential human health hazards associated with synthetic fossil-fuel technologies. Studies in progress are investigating the carcinogenic potential of cutaneous exposure to various chemically derived fractions or boiling-point distillates of materials and products from the solvent-refined coal technology.

28708 (PNL—4100-Pt.1, pp 15-19) **Perinatal effects of SRC.** Springer, D.L. Feb 1982. NTIS, PC A10/MF A01.

In Pacific Northwest Laboratory annual report for 1981 to the DOE Office of Energy Research. Part 1. Biomedical sciences.

Studies were conducted to determine whether in utero exposure of rats to high-boiling coal liquid caused adverse effects relative to the following endpoints: survival, body weight, immune system development, metabolic enzyme activity, and behavior. The data indicate that the treatment increased the incidence of fetal and neonatal mortality. Body weights at 1 day of age were significantly less in the heavy-distillate-(HD)-treated groups and in the process-solvent-(PS)-treated group. Perinatal growth was retarded through 21 days of age in the HD- and PS-treated groups at the highest doses. Immunocompetence also was altered by exposure to these materials. Few changes were observed either in enzyme activities or behavior; changes in these parameters were less sensitive as measures of effects than survival and weight gain.

28709 (PNL—4100-Pt.1, pp 21-24) **Teratology of SRC-II materials.** Sikov, M.R. Feb 1982. NTIS, PC A10/MF A01.

In Pacific Northwest Laboratory annual report for 1981 to the DOE Office of Energy Research. Part 1. Biomedical sciences.

Data from previous survey experiments indicated that some SRC-II materials of pilot-plant origin were embryocidal and teratogenic when administered to pregnant rats at doses approximating the maternally toxic level. This project was initiated in FY 1981 to quantify the developmental toxicity of these materials. The approach is to develop precise dose-response relationships, in rodents, to determine if levels of materials that are subthreshold for maternal toxicity are capable of affecting intrauterine growth and survival or of altering morphogenesis so as to result in malformations or other morphologic changes. These experiments may provide indications of the minimal toxic levels of SRC materials, since the embryo has been found to be a sensitive indicator of the toxicity of many substances.

28710 (PNL—4100-Pt.1, pp 25-27) **Inhalation hazard to coal miners.** Karagianes, M.T. Feb 1982. NTIS, PC A10/MF A01.

In Pacific Northwest Laboratory annual report for 1981 to the DOE Office of Energy Research. Part 1. Biomedical sciences.

Acceleration in coal mining activities to satisfy present and future energy needs may be constrained by potentially severe health hazards. Coal workers' pneumoconiosis (CWP), a chronic debilitating disease associated with coal mine dust, is one known entity; additional inhalation hazards may occur with the proposed

extensive use of diesel engines in coal mines. The objectives of this project are to evaluate the biological effects of specific mine air contaminants in experimental animals, and to study the progression of chronic respiratory pathologic changes that occur with coal dust and/or diesel exhaust inhalation.

28711 (PNL—4100-Pt.1, pp 29-32) **Factors influencing cross-placental transfer and teratogenicity of metallic pollutants.** Hackett, P.L. Feb 1982. NTIS, PC A10/MF A01.

In Pacific Northwest Laboratory annual report for 1981 to the DOE Office of Energy Research. Part 1. Biomedical sciences.

Studies are in progress to determine potentially embryotoxic effects of vanadium in rats. Both dose level and stage of gestation (9, 15, or 19 dg) significantly influenced V distribution in maternal tissues and V accumulation in the FPU. Parenteral administration of high doses of V at 15 dg produced maximal intrauterine mortality even though V deposition was highest in the 19-dg FPU. The major fraction of the V burden in the FPU was in the membranes. In animals injected at 9 or 15 dg, for whom intrauterine exposure is extended, fetal accumulation was independent of dose. For shorter exposure periods resulting from injection at 19 dg, fetal V burdens were proportional to the dose.

28712 (PNL—4100-Pt.1, pp 55-59) **Aerosol technology development.** Cannon, W.C. Feb 1982. NTIS, PC A10/MF A01.

In Pacific Northwest Laboratory annual report for 1981 to the DOE Office of Energy Research. Part 1. Biomedical sciences.

A variety of tasks are included in this project, all designed to improve the capabilities of this laboratory to conduct animal inhalation exposures to airborne pollutants, and to characterize the aerosols used. These tasks include development of an improved, nose-only aerosol exposure chamber for rats; improvement of a new dry-dust feeder for aerosol generation; measurement of the surface area of volcanic-ash particles; development of a new way to describe aerosol particle-size distribution which can be used with programmable pocket calculators; and comparative testing of a method for inhalation exposure chamber evaluation.

28713 (PNL—4100-Pt.1, pp 99) **Toxicity of sodium-lithium.** Busch, R.H. Feb 1982. NTIS, PC A10/MF A01.

In Pacific Northwest Laboratory annual report for 1981 to the DOE Office of Energy Research. Part 1. Biomedical sciences.

Rats were exposed to inhaled sodium carbonate aerosols (2600 $\mu g/L$) to detect possible effects on immunologic responsiveness. Immunologic testing revealed reduced response of spleen cells to mitogens and a reduced proportion of T-lymphocytes in spleen-cell preparations during the period 3 to 4 days after exposure.

28714 (PNL—4100-Pt.1, pp 139-142) **Metal-membrane interactions.** Schneider, R.P. Feb 1982. NTIS, PC A10/MF A01.

In Pacific Northwest Laboratory annual report for 1981 to the DOE Office of Energy Research. Part 1. Biomedical sciences.

The ionic forms of most toxic metals penetrate cell membranes slowly; it therefore seems likely that many of their effects are exerted at the membrane level or are determined by membrane-regulated entry into cells. An important function of membranes is to transmit signals from impermeant molecules in the extracellular space to the cell nucleus, where genes are switched on and off in response to changes in the extracellular medium. Using Neurospora crassa as a model of this function, it was shown that cells deprived of phosphorus, nitrogen or carbon secrete an enzyme to digest RNA in response to the presence of extracellular protein. In another study, it was found that depriving the cells of zinc results in the synthesis of a high-affinity uptake system for zinc that enhances their ability to take up the metal by 1000-fold.

28715 (PNL—4100-Pt.1, pp 143-146) **Alveolar clearance of inhaled metal oxides.** Sanders, C.L. Feb 1982. NTIS, PC A10/MF A01.

In Pacific Northwest Laboratory annual report for 1981 to the DOE Office of Energy Research. Part 1. Biomedical sciences.

Metal oxides produced during the combustion of fossil fuels constitute a potential hazard to man. The objectives of this project are to determine the fate of metals deposited in the lung, particularly as influenced by pulmonary cellular dynamics, and their acute and chronic toxicity.

28716 (PNL—4100-Pt.2, pp 127) **Ecological effects of lithium and beryllium on aquatic communities.** Poston, T.M. Feb 1982. NTIS, PC A08/MF A01.

In Annual Report for 1981 to the DOE Office of the Assistant Secretary for Environmental Protection, Safety, and Emergency Preparedness. Part 2. Ecological Sciences.

The purpose of this study is to examine the ecological significance of elevated concentrations of lithium and beryllium in freshwater systems.

28717 (PNL—4100-Pt.4, pp 11-15) **Modeling cellular effects of coal pollutants.** Feb 1982. NTIS, PC A06/MF A01.

In Pacific Northwest Laboratory annual report for 1981 to the DOE Office of Energy Research. Part 4. Physical sciences.

The important role of cellular repair processes in protecting living organisms from damage induced in DNA by ionizing and ultraviolet (UV) irradiation is well established. The goal of this project is to apply concepts of repair developed in radiation biology to obtain a better understanding of the risk associated with exposure to coal-related chemical carcinogens. A model proposed to explain the effect of repair on the survival of bacteria exposed to UV irradiation has been successfully applied to the dose-response of human cells exposed to the aromatic amide carcinogen N-acetoxy-2-acetylaminofluorene. Our experimental program has isolated a mutant of the rodent cell line, CHO-K1, that exhibits a lower mutation frequency than the parent cell line following exposure to benzo[a]pyrene-4,5-oxide. Permeability studies with polynuclear aromatic hydrocarbons show that these compounds have a high affinity for the nonpolar, lipid phase of cell membranes. These results are important for understanding the pathway for metabolic activation of these compounds.

28718 (PNL—4100-Pt.4, pp 77-89) **Oil shale and tar sands research.** Feb 1982. NTIS, PC A06/MF A01.

In Pacific Northwest Laboratory annual report for 1981 to the DOE Office of Energy Research. Part 4. Physical sciences.

Oil shale and tar sand in the United States represent a potential supply of nearly one trillion barrels of crude oil. The renewed commercial interest in developing these reserves has increased the need for studies that would help developers assure that conversion processes are environmentally acceptable. A vital part of this environmental research program is the physical and chemical characterization of the effluents from the various proposed conversion schemes. The complex nature of the effluents has required the development of new procedures for sampling, analyzing, and chemically separating them. In this section, new and improved techniques for organic, inorganic and speciation analysis are presented with application for oil shale research. Also reported is the progress of a program to provide representative and well-characterized fossil-fuel samples for environmental and health effects studies and for interlaboratory comparisons to ensure accuracy of the data.

28719 **Cytochrome P-450-dependent monooxygenases in olfactory epithelium of dogs: possible role in tumorigenicity.** Dahl, A.R. (Inhalation Toxicology Research Inst., Albuquerque, NM); Hadley, W.M.; Hahn, F.F.; Benson, J.M.; McClellan, R.O. *Science (Washington, D.C.);* **216**: 57-59(2 Apr 1982). Contract AC04-76EV01013.

The respiratory tract epithelium of dogs, from the nose to the lungs, was examined for cytochrome P-450 and associated biotransformation activities. In the ethmoturbinates, where olfactory epithelium is located, the amount of cytochrome P-450 was comparable to that in the liver, when measured on the basis of activity per milligram of microsomal protein. The rest of the nasal region also contained large quantities of cytochrome P-450. The presence of these enzymes in the nose may be important in chemical-induced tumorigenesis. The nasal carcinogen hexamethylphosphoramide was shown to be metabolized by nasal microsomal enzymes to another nasal carcinogen, formaldehyde.

28720 **Evidence that DNA polymerases α and β participate differentially in DNA repair synthesis induced by different agents.** Miller, M.R.; Chinault, D.N. (West Virginia Univ. Medical Center, Morgantown). *Journal of Biological Ch.);* **257**: No. 1, 46-49(Jan 1982). Contract FG22-80PC30248.

The roles of DNA polymerases α and β in DNA replication and repair synthesis were studied in permeable animal cells, using different agents to induce repair synthesis. DNA polymerase inhibitors were used to investigate which polymerases were involved in repair synthesis and in replication. Polymerase α was responsible for replication. On the other hand, both polymerases α and β were involved in DNA synthesis; the extent to which each polymerase participated depended primarily on the agent used to damage DNA. Polymerase β was primarily responsible for repair synthesis induced by bleomycin or neocarcinostatin, whereas polymerase α played a more prominent role in repair synthesis induced by N-methylN' -nitro-N-nitrosoguanidine or N-nitrosomethyl urea. More DNA damage was induced by the alkylating agents than by bleomycin or neocarcinostrain, suggesting that the extent of involvement of polymerase α or β in DNA repair synthesis is related to the amount or type of DNA damage. In addition, salt cocentration was found to have little or no effect on the results obtained with the DNA polymerase inhibitors. Our findings provide an explanation for conflicting reports in the literature concerning the roles of DNA polymerases α and β in DNA repair.

28721 **Comparison of the mutagenic and potentially carcinogenic activity of particle bound organics from wood stoves, residential oil furnaces, and other combustion sources.** Lewtas, J. (Environmental Protection Agency, Research Triangle Park, NC). pp 606-619 of Residential solid fuels: environmental impacts and solutions. Cooper, J.A.; Malek, D. (eds.). Beaverton, OR; Oregon Graduate Center (1982).

From 1981 international conference on residential solid fuels; Portland, OR, USA (1 Jun 1981).

Incomplete combustion products emitted from a variety of sources have been shown chemically to contain known carcinogenic polycyclic aromatic hydrocarbons and in several cases are recognized as human carcinogens (e.g., chimney soot). These combustion emissions upon dilution and cooling contain significant quantities of filterable particles bound with condensed organic matter. The relative mutagenic and carcinogenic activity of a series of these organics is being compared from the following emission sources: residential wood stoves, residential oil heaters, diesel and gasoline vehicles. The biological activity of these emissions is being compared to the activity of complex organics from roofing tar pots, coke ovens ambient collection, and cigarette smoke condensate emissions for which human epidemiological data have been reported. The bioassays include in vitro microbial and mammalian cell mutagenesis assays as well as in vivo skin carcinogenesis assays in rodents. Microbial mutagenesis data for the extractable organics from wood stove particle emissions will be compared to these other sources. Both the biological activity and organic emission rate will be considered in comparing these sources and their potential environmental impact.

28722 **Multimedia human exposure to polycyclic aromatic hydrocarbons and their association with cancer risk.** Howard, P.H. (Syracuse Research Corp., NY); Santodonato, J.; Basu, D.; Bruce, R. pp 620-647 of Residential solid fuels: environmental impacts and solutions. Cooper, J.A.; Malek, D. (eds.). Beaverton, OR; Oregon Graduate Center (1982).

From 1981 international conference on residential solid fuels; Portland, OR, USA (1 Jun 1981).

Polycyclic aromatic hydrocarbons (PAH) are one of the more important chemical classes of pollutants emitted to the atmosphere during residential wood combustion because they are well recognized environmental carcinogens. However, humans are exposed to PAH not only from the air they breathe but also from drinking water, food, and tobacco smoking. Thus, the total PAH human exposure must be considered in order to place in perspective the health effects of residential wood burning. The quantitative aspects of exposure to PAH from these sources are examined and need to be compared to exposure that can be attributed to residential wood burning. In addition, extrapolation of the data on the carcinogenic effects of PAH in experimental mammals is presented to define levels of carcinogenic risk in humans. 105 references.

28723 **Prenatal toxicology of shale oil retort water in mice.** Gregg, C.T.; Tietjen, G.; Hutson, J.Y. (Los Alamos National Lab., NM). *Journal of Toxicology and Environmental Health;* **8**: No. 5-6, 795-804(Nov 1981).

Shale oil retort water, a by-product of the production of oil from shale, potentially amounts to tens of millions of gallons per year and must be treated or recycled with regard for public health. Such retort water was given to 98 female ICR/DUB mice in their drinking water at concentrations of 0, 0.1, 0.3, and 1.0% for periods up to 203 d. Seven of 75 treated animals developed adenomalike lesions that were not seen in the control animals. These ranged from adenomas and an adenomatoid nodule in the lung to a rectal adenocarcinoma. Although the incidence of adenomalike lesions was not statistically significant, this appearance of neoplasia requires further investigation. Eighty-five animals became pregnant. The proportion of animals pregnant, weights of nonpregnant animals, weight gain during pregnancy, average fetal weight, number of live fetuses per litter, and proportion of male fetuses were unaffected by drinking retort water. Early and late fetal deaths and preimplantation losses were likewise unaffected, except for a significant increase in preimplantation losses in animals consuming 1.0% retort water. A variety of palatal defects were seen in treated animals, however, including single and multiple cleft palates and a defect, to our knowledge not previously reported, in which the posterior portion of one or both palatal shelves appeared not to have formed. The palatal deffects, as a group, were dose-dependent and statistically significant.

28724 **Pathogenesis of nitrogen dioxide-induced respiratory lesions in reference to respiratory clearance of inhaled particulates.** Creasia, D.A. (Oak Ridge National Lab., TN). *Journal of Toxicology and Environmental Health;* **8**: No. 5-6, 857-871(Nov 1981).

The pathogenesis of NO_2-induced respiratory disease and the effect of NO_2 on respiratory clearance of $^{51}Cr_2O_3$ were studied. Young adult female mice were exposed to a $^{51}Cr_2O_3$ aerosol, followed by a daily exposure to either 30 ppm NO_2 for 2 wk or 60 ppm NO_2 for 2 wk or a single exposure to 170 ppm NO_2. Exposure to 30 ppm NO_2 had minimal histopothologic effect on respiratory tract tissue. Exposure to 60 ppm NO_2 produced marked histopathologic effects, which were subsequently resolved. Exposure to 170 ppm NO_2 produced permanent histopathologic lesions. In mice exposed to concentrations of NO_2 that produced minimal histopathologic effects, respiratory clearance of $^{51}Cr_2O_3$ was similar to that in unexposed mice. When mice were exposed to concentrations of NO_2 that produced permanent tissue damage, prolonged impairment of respiratory clearance of $^{51}Cr_2O_3$ was observed, despite resolution of edema produced by inhalation of NO_2. At concentrations of NO_2 that produced marked edema and histopathologic effects that were resolved despite repeated NO_2 exposure, there was an initial marked impairment of respiratory clearance, then an accelerated rate of clearance, and finally a clearance rate similar to that of unexposed mice. The time during which accelerated clearance occurred was well correlated with the time at which the histopathologic lesion was observed to regress.

28725 **Comparative effects of cadmium, zinc, and lead in vitro on pulmonary, adrenal, and hepatic microsomal metabolism in the guinea pig.** Colby, H.D.; Johnson, P.B.; Zulkoski, J.S.; Pope, M.R.; Miles, P.R. (West Virginia Univ. School of Medicine, Morgantown). *Journal of Toxicology and Environmental Health;* **8**: No. 5-6, 907-915(Nov 1981). Contract AT21-79MC21284.

The in vitro effects of Cd, Zn, and Pb on pulmonary, adrenal, and hepatic microsomal enzyme activities in guinea pigs were compared. Cd and Zn produced concentration-dependent (20-200 μM) decreases in benzphetamine demethylase and biphenyl hydroxylase activities in adrenal, liver, and lung. Pb had no significant effect on either enzyme in any of the tissues studied. Adrenal and pulmonary enzymes were more sensitive to the effects of Cd and Zn than were hepatic enzymes. Benzo[a]pyrene hydroxylase and ethoxycoumarin demethylase activities were decreased by Zn, Cd and Pb in adrenal, liver, and lung microsomes. The inhibitory ef-

fects on benzo[a]pyrene and ethoxycoumarin methabolism were far greater than those on benzphetamine or biphenyl metabolism. The relative potencies of the metals as inhibitors of xenobiotic metabolism were Zn > Cd > Pb. Cd and Zn also inhibited steroid 21-hydroxylase activity in adrenal microsomes, but Pb had no effect on steroid metabolism. In addition, microsomal epoxide hydratase activity in adrenal, liver, and lung was inhibited by Cd but not by Zn or Pb. The results demonstrate that adrenal and pulmonary microsomal enzyme, like those in liver, are inhibited by various metals. Inhibition of mixed-function oxidases by metals in vitro is apparently not related to changes in cytochrome P-450 levels or substrate binding to cytochrome P-450. In addition, the actions of Cd, Zn, and Pb in each tissue are highly dependent on the substrates employed.

28726 **Systemic absorption of selenious acid and elemental selenium aerosols in rats.** Medinsky, M.A.; Cuddihy, R.G.; McClellan, R.O. (Lovelace Biomedical and Environmental Research Inst., Albuquerque, NM). *Journal of Toxicology and Environmental Health;* 8: No. 5-6, 917-928(Nov 1981). Contract AC04-763V1013.

Absorption of Se from the nasal passages, lung, gastrointestinal tract, and skin was studied in Fischer-344 rats. Radiolabeled selenious acid and elemental Se particles were administered by inhalation, nasal instillation, and iv injection. Selenious acid was always absorbed into the general circulation more rapidly and to a greater extent than elemental Se. By 4 hr after inhalation of selenious acid and elemental Se aerosols, 94% of the selenious acid and 57% of the elemental Se deposited in lungs was absorbed into blood. Of the selenious acid instilled into nasal passages, 18% was absorbed into blood; 16% of the elemental Se was absorbed. Gastrointestinal absorption was 87% for selenious acid and 50% for elemental Se. Selenious acid solutions were also painted onto the pelts of rats. From 10 to 30% of the selenious acid was absorbed through the skin. Following inhalation or injection of either Se compound, most of the Se was excreted in the urine. Significantly more Se appeared in feces of animals receiving elemental Se by gavage than animals receiving selenious acid. Results indicate that if people were to absorb inhaled Se from the upper respiratory tract in a manner similar to that of rats, one-third more selenious acid would be absorbed into the general circulation than elemental Se. All Se deposited in the lungs would be absorbed into blood. However, selenious acid would be absorbed more rapidly than elemental Se.

28727 **Pharmacodynamic behavior of [^{14}C]acridine in the cricket Acheta domesticus (L.).** Walton, B.T.; Maggart, E.F. Jr. (Oak Ridge National Lab., TN). *Journal of Toxicology and Environmental Health;* 8: No. 5-6, 989-999(Nov 1981). Contract W-7405-ENG-26.

Cuticular and gastrointestinal penetration, in vivo metabolism, and excretion of [^{14}C]acridine were investigated in the nymphal cricket Acheta domesticus (L.) to find a pharmacodynamic basis for this insect's differential susceptibility to acridine at different life stages. Topically applied [^{14}C]acridine readily penetrated the cuticular exoskeleton of nymphs (half-time of penetration, 48 min). Radiolabeled compounds appeared in the hemolymph within 0.5 h after ingestion of [^{14}C]acridine and continued to move across the gut wall for 7.5 h. The biological half-time was 18 h and the rate constant for elimination was 0.039 h^{-1} after ingestion. Within 5 d after dosing, 97% of the dose was excreted. Several metabolites were present in the feces of nymphs fed [^{14}C]acridine, and less than 13% of the extractable radioactivity was parent compound. The cuticule and the gastrointestinal tract proved to be ineffective barriers to acridine entry in A. domesticus. However, the ability to readily metabolize and excrete acridine probably contributes to the higher acridine tolerance observed in the nymphs and adults than in the eggs, which are susceptible to toxic effects. Acridine is found in many coal and synthetic fuel by-products.

28728 **Toxicity testing system for exposing small invertebrates and fish to short square-wave concentrations of chlorine.** Mattice, J.S.; Burch, M.B.; Tsai, S.C.; Roy, W.K. (Oak Ridge Natl Lab, Tenn, USA). *Water Research;* 15: No. 7, 923-927(1981).

The paper describes a toxicity system which is constructed of simple, and readily available components, presents evidence that the system produces a close approximation to a square-wave concentration curve during exposure, and demonstrates that the system can be used to determine short-term toxicity of chlorine to planktonic invertebrates and small fish. 27 refs.

28729 **Induction of dark keratinocytes by 12-O-tetradecanoylphorbol-13-acetate and mezerein as an indicator of tumor-promoting efficiency.** Klein-Szanto, A.J.P.; Major, S.K.; Slaga, T.J. (Oak Ridge National Lab., TN). *Carcinogenesis (New York);* 1: 399-406(May 1980). Contract W-7405-ENG-26.

12-O-Tetradecanoylphorbol-13-acetate (TPA) and mezerein (MZ) are diterpene esters of similar structure and approximately equipotent on a molar basis as far as their hyperplasiogenic, inflammatogenic, and induction of ornithine decarboxylase activity effects in mouse skin are concerned. On the other hand, TPA is much more effective than MZ as a tumor promoter. The percentage of dark basal keratinocytes was determined in the interfollicular epidermis (IFE) of mice topically treated with 1, 2, or 4 μg of either TPA or MZ in a single application and studied at 12, 24, 48, 96, and 144 h thereafter. The results showed that TPA induced 2 to 3 times more dark cells than MZ in the IFE as well as in the infundibular portion of the hair follicle. The latter epithelium presented a larger number of dark keratinocytes than the IFE in all experimental and control situations, and the differences between the effects of TPA and MZ were even greater in the infundibular epidermis than in the IFE. TPA induced an increase of 5 to 11 times over the control number of dark cells (~ 2% in IFE), reaching maximum values of 21% in the basal layer 24 h after topical application of 4 μg of TPA. MZ only produced a 3- to 6-fold increment. The labeling indices of the basal layer and of the dark basal cells were markedly and similarly increased with both compounds. The different dark-cell inducing characteristics seem to be the only detectable difference in early effects produced by TPA and MZ and would point to the importance of the production of the dedifferentiated dark cells during early stages of tumor promotion.

28730 **Metabolism of carcinogenic 2-hydroxybenzo[a]pyrene in rodent and human cells.** Moore, C.J. (Tenn. Univ., Oak Ridge); McClusky, G.A.; Fischer, S.M.; MacLeod, M.C.; Slaga, T.J.; Selkirk, J.K. *Carcinogenesis (New York);* 1: No. 12, 979-987(1980). Contract W-7405-ENG-26.

The rates of metabolism of the carcinogenic 2-hydroxybenzo[a]pyrene (2-OH-B[a]P) and the noncarcinogenic 3- and 9-hydroxybenzo[a]pyrenes in cultured cell systems have been studied and compared. While 70 to 80% of the non-carcinogens are converted to water-soluble derivatives by hamster embryo fibroblasts in 24 h, carcinogenic 2-OH-B[a]P is metabolized at a slower rate (45% in 24 h), comparable to that for the parent hydrocarbon, benzo[a]pyrene (B[a]P). Analysis of extracellular organic solvent-soluble metabolites of 2-OH-B[a]P in cultured hamster embryo fibroblasts, using h.p.l.c., indicates the presence of a single major metabolite, which has been identified by mass spectroscopy as a dihydroxy derivative of B[a]P. At least one additional major organic solvent-soluble metabolite is formed in cultures of either mouse epidermal epithelial cells or human foreskin fibroblasts, indicating a different balance of metabolic pathways in these cell systems. The greater persistence of carcinogenic 2-OH-B[a]P in cells and its higher concentration in the cell cytoplasm compared with the non-carcinogenic phenols may be related to its relatively high biological activity. Differences in metabolism of 2-OH-B[a]P in several cultured cell systems indicate the importance of an appropriate choice of activating system in understanding the relationship between metabolism and carcinogenesis.

28731 **Quantitative analysis of disturbed cell maturation in dysplastic lesions of the respiratory tract epithelium.** Klein-Szanto, A.J.P.; Nettesheim, P.; Topping, D.C.; Olson, A.C. *Carcinogenesis (New York);* 1: No. 12, 1007-1016(1980). Contract W-7405-ENG-26.

Autoradiographic patterns of [^{3}H]thymidine incorporation, nuclear/cytoplasmic ratios (N/C), and the percentage of dark epithelial cells were analyzed in a group of epithelial lesions induced by 7,12-dimethylbenz[a]anthracene (DMBA) in rat tracheal transplants.

It was found that similar lesions of different age exhibit the same labeling indices (LIs), therefore the lesions of different age were subsequently pooled in the following groups and studied by high resolution light microscopic autoradiography: squamous metaplasia without or with only mild atypia, squamous metaplasia with moderate atypia, squamous metaplasia with severe atypia, carcinoma in situ, and microinvasive carcinoma. Normal tracheal and esophageal epithelia were also analyzed. Gradients of increasing N/C (nucleus-cytoplasm ratios) values could be observed as the lesions increased in severity, especially in the middle and surface layers (e.g., in the surface layer regular metaplasia N/C = 0.08, squamous metaplasia with moderate atypia N/C = 0.26, and carcinoma in situ N/C = 0.50). Dark cells were absent in the normal esophageal epithelium, were present in moderate numbers in the basal layer of regular squamous metaplasia (18%), and increased markedly in the atypical epithelial lesions (approximately 50% in the atypical squamous metaplasias and 70% in carcinoma in situ). In the suprabasal layer dark cells increased from 3% in squamous metaplasia with moderate atypia to 28% in metaplasia with severe atypia and 56% in carcinoma in situ. The results confirm in a quantitative fashion that disturbances of cell maturation and cell proliferation are key features of dysplastic lesions induced by chemical carcinogens, and suggest the use of objective parameters for evaluation and classification of preneoplastic alterations.

28732 **Effects of calcium, magnesium, lead, or cadmium on lipoprotein metabolism and atherosclerosis in the pigeon.** Revis, N.W. (Univ. of Tennessee, Oak Ridge); Major, T.C.; Horton, C.Y. *Journal of Environmental Pathology and Toxicology;* **4-2**: No. 3, 293-304(1980). Contract W-7405-ENG-26.

Epidemiological and clincal studies suggest that the incidence of atherosclerosis is higher in soft-water areas than in hard-water areas. In an attempt to discern the factor(s) in drinking water that may be associated with these observations, the current studies were performed to determine the effects of several elements associated with hard (i.e., calcium and magnesium) or soft (i.e., calcium and magnesium) or soft (i.e., cadmium and lead) water in the induction and progression of atherosclerosis in the white carneau pigeon. The effect of these elements on lipoprotein metabolism was also assessed because it has been suggested that changes in the metabolism of lipoprotein may play a role in the etiology of atherosclerosis. Results show that the number and size of atherosclerotic plaques in the aorta were increased in pigeons given drinking water containing lead and/or cadmium. The effects of these elements were antagonized by the addition of calcium to drinking water containing lead and/or cadmium. Although lead and cadmium altered the profile of lipoproteins, this change did not appear to be related to an increase in the number and size of atherosclerotic plaques of the aorta. However, in pigeons treated with calcium alone the low-density lipoprotein (LDL) increased fourfold, and arteriosclerosis of the coronary arteries was observed. This result suggests that marked increases in the LDL protein may be related to arteriosclerosis of the coronary arteries. Based on these preliminary results, we suggest that lead, cadmium, and the LDL protein may be important factors in the induction and progression of atherosclerosis and arteriosclerosis in the pigeon.

28733 **Binding of benzo(a)pyrene to epidermal DNA and RNA as detected by synchronous luminescence spectrometry at 77 K.** Rahn, R.O.; Chang, S.S.; Holland, J.M.; Stephens, T.J.; Smith, L.H. (Oak Ridge National Lab., TN). *Journal of Biochemical and Biophysical Methods;* **3**: 285-291(1980). Contract W-7405-ENG-26.

The fluorescence associated with benzo(a)pyrene (BP) moieties covalently attached to the nucleic acid (DNA plus RNA) isolated from the epidermis of BP-treated mice was examined at 77 K in frozen aqueous solutions by use of a photon-counting fluorimeter operating in the synchronous scanning mode. The excitation and emission wavelengths were scanned simultaneously with the monochromators set 28 nm apart. This setting coincides with the difference in wavelength between the excitation and emission maxima for the fluorescence of bound BP. Currently the level of detection is in the order of 1 BP residue per 200,000 bases in 40 μg of nucleic acid. This amount of nucleic acid can be isolated from the skin of a single mouse. The method described here is generally useful for detecting the binding to DNA of nonradioactive carcinogenic polynuclear aromatics which might occur following the topical application to animal skin in vivo of complex hydrocarbon mixtures such as synthetic fuels and crude oils.

28734 **Comparative uptake of naphthalenes from water and oiled sediment by benthic amphipods.** Anderson, J.W.; Kiesser, S.L.; Blaylock, J.W. (Battelle, Pac Northwest Lab, Sequim, Wash). *American Petroleum Institute, Publication;* No. 4308, 579-584(1979). (CONF-7903164—).

From Oil spill conference: prevention, behavior, control, cleanup; Los Angeles, CA, USA (19 Mar 1979).

The benthic amphipod, Anonyx laticoxae, was exposed to whole oil on sediments or water extracts of Prudhoe Bay crude oil under both static and flowing conditions. Time periods of exposure ranged from 4 to 27 days and, while a range of compounds was present, the only class measured in water, tissues, and sediments was naphthalenes. Compared to levels in the surrounding environment (sediment or water) tissue magnification was least during sediment exposures (2-4 times), greatest in a flowing exposure system (about 1000 times), and intermediate during static water exposure (10-50 times). During a constant exposure to 22 ppb total naphthalenes (0.506 ppm total hydrocarbons) the amphipids reached a threshold of accumulation after about seven days, and the majority of contamination was from alkylnaphthalenes. 22 refs.

5604 Other Environmental Pollutant Effects

28735 **(PB—81-155137) Field maxima inside habitable structures exposed to 2.45 gHz plane wave radiation.** Liebe, H.J. (National Telecommunications and Information Administration, Boulder, CO (USA). Inst. for Telecommunication Sciences). Oct 1980. 47p. NTIS, PC A03/MF A01.

This report discusses microwave engineering data relevant to assess the potential of the Satellite Power System (SPS) to cause microwave field enhancements (so-called hot spots) inside habitable structures (house, trailer, car, etc.) located in the fringe area of the receiving rectenna. Mitigative measures are included in the discussion.

28736 **(PB—81-803843) Biological effects of laser radiation. January 1978-February 1981 (citations from the NTIS data base). Report for Jan 1978-Feb 1981.** (National Technical Information Service, Springfield, VA (USA)). Feb 1981. 69p. NTIS PC N01/MF N01.

The bibliography cites reports on radiation injuries, permissible dosage, protective devices, and safety measures. Included are references on the pathology of eye lesions caused by lasers. (This updated bibliography contains 60 citations, 21 of which are new entries to the previous edition.)

28737 (PNL—4100-Pt.1, pp 37-38) **Mutagenic effects of electric fields.** Hungate, F.P. Feb 1982. NTIS, PC A10/MF A01.

In Pacific Northwest Laboratory annual report for 1981 to the DOE Office of Energy Research. Part 1. Biomedical sciences.

Data have been inconclusive from experiments designed to ascertain if exposure to electric fields causes biological effects in mammals and have not yet led to identifying mechanisms by which effects might be produced. In vitro exposure of cells in suspension, however, allows measurement of cellular effects in field strengths much higher than those to which whole animals can be exposed. The present study is designed to examine simple cell systems for evidence as to whether electric fields affect the function of the genetic system. At this stage, there is no evidence that even the highest field strengths affect the normal cell mutation frequency; however, gene expression is affected, as shown by increased frequency of induced phage.

28738 (PNL—4100-Pt.1, pp 39-42) **Electric field dosimetry.** Kaune, W.T. Feb 1982. NTIS, PC A10/MF A01.

In Pacific Northwest Laboratory annual report for 1981 to the DOE Office of Energy Research. Part 1. Biomedical sciences.

Data on electric fields and current densities inside the bodies of animals and humans are needed to relate exposure levels used in the laboratory with experimental animals to those experienced by humans from electric-power generation, transmission, and distribu-

tion systems. We report here preliminary measurements in the bodies of homogeneous models of humans, rats, and swine exposed to 1-kV/m, 60-Hz electric fields.

28739 (PNL—4100-Pt.1, pp 43-45) **In vivo mutagenesis of electric fields.** McClanahan, B.J. Feb 1982. NTIS, PC A10/MF A01.

In Pacific Northwest Laboratory annual report for 1981 to the DOE Office of Energy Research. Part 1. Biomedical sciences.

Exposure to a 60-Hz electric field, at an unperturbed field strength of 100 kV/m, for 8 hr/day for 5 days, did not induce unscheduled DNA synthesis in mouse spermatocytes or impair the cells' ability to repair DNA damage induced by the mutagen, ethyl methanesulfonate. There was no detectable increase in abnormal sperm or numbers of sperm recovered from the caudae epididymides of exposed mice compared with those of the sham-exposed animals.

28740 (PNL—4100-Pt.1, pp 47-49) **In vitro effects of electric fields.** Frazier, M.E. Feb 1982. NTIS, PC A10/MF A01.

In Pacific Northwest Laboratory annual report for 1981 to the DOE Office of Energy Research. Part 1. Biomedical sciences.

This project seeks to measure cytotoxicity, DNA damage and/or specific gene mutation resulting from exposure of mammalian cells in suspension to 60-Hz electric fields. Exposure of CHO-K1 cells to 60-Hz electric fields as high as 3.1 V/m for 48 hr did not increase the observable mutation frequency at a specific gene locus (HGPRT). However, exposure of CHO-K1 cells to 3.1 V/m for 1 hr resulted in a significant decrease in cell survial as measured using a clonal growth assay. In order to establish a dose-response relationship, it will be necessary to expose the cells to electric fields in excess of 10 V/m. To achieve this goal a new type of cell exposure system using carbon electrodes, with an agar bridge between electrodes and the cell culture chamber has been designed and tested.

28741 (PNL—4100-Pt.1, pp 133-136) **Biological effects of magnetic fields.** Mahlum, D.D. Feb 1982. NTIS, PC A10/MF A01.

In Pacific Northwest Laboratory annual report for 1981 to the DOE Office of Energy Research. Part 1. Biomedical sciences.

This project has as its major thrust the evaluation of a variety of biological systems for their sensitivity to magnetic fields. The systems being explored range from cell culture to pre- and postnatal development in the rat. In addition to studies on the effects of magnetic fields on whole-animal systems, another phase of these studies has been the investigation of possible mechanisms by which magnetic fields couple to biological systems. Progress on the new magnetic-field exposure facilities, the effect of magnetic fields on fertilization of trout eggs, and results of molecular studies on the interaction of organic compounds with magnetic fields are reported here.

28742 (PNL—4100-Pt.2, pp 129-131) **Teratogenic effects of low-level magnetic fields.** Strand, J.A.; Abernethy, C.S. Feb 1982. NTIS, PC A08/MF A01.

In Annual Report for 1981 to the DOE Office of the Assistant Secretary for Environmental Protection, Safety, and Emergency Preparedness. Part 2. Ecological Sciences.

Initial studies conducted at this laboratory suggested that the fertility of trout eggs could be affected by magnetic fields of 1 tesla (T). Additional studies were performed to confirm these results and to examine the relative susceptibility of eggs and sperm to magnetic fields. Preliminary results and an interpretation of the data are presented below.

28743 (PNL—4100-Pt.2, pp 165) **Biological studies of a 1200-kV prototype transmission system.** Feb 1982. NTIS, PC A08/MF A01.

In Annual Report for 1981 to the DOE Office of the Assistant Secretary for Environmental Protection, Safety, and Emergency Preparedness. Part 2. Ecological Sciences.

This is an ongoing study for Bonneville Power Administration (BPA) an arm of DOE. The study, located at BPA's 1100-kV prototype line located near Lyons, Oregon, is the first research to monitor the effects of a transmission line of this voltage on a natural ecosystem.

57 Health And Safety

REFER ALSO TO CITATION(S) 28515

58 GEOSCIENCES

5801 Geology And Hydrology

REFER ALSO TO CITATION(S) 27739

28744 (LBL—12100, pp 13-18) **Buoyancy flows in fractures intersecting a nuclear waste repository.** Wang, J.S.Y.; Tsang, C.F. Jul 1981. NTIS, PC A12/MF A01. Order Number DE82000804.

In Earth Sciences Division annual report 1980.

Heat released from a nuclear waste repository in a geological formation signifcantly increases the temperature of surrounding rock masses as well as the groundwater in the formations, inducing buoyancy fluid flow. An understanding of the resulting perturbation of the original regional hydrological pattern may be crucial in determining the performance of repositories in which nuclear waste materials are to be isolated from the biosphere. Regional groundwater flow through several major fractures in low-permeability crystalline rock has been simulated as a worst-case scenario.

28745 (LBL—12100, pp 19-24) **Probabilistic simulation of transient groundwater flow: an alternative to the Monte Carlo scheme.** Narasimhan, T.N.; Buscheck, T.E.; Witherspoon, P.A. Jul 1981. NTIS, PC A12/MF A01. Order Number DE82000804.

In Earth Sciences Division annual report 1980.

On the basis of favorable indications of the preliminary work, the necessary computer subroutines for handling probability arithmetic were generated and incorporated into an explicit version for program TERZAGI, which is an integral finite-difference method (IFDM) (Narasimhan and Witherspoon, 1976). This program solves the transient groundwater flow equation (based on principles identical to those of the heat conduction equation) in one, two, or three dimensions. During fiscal 1980, the modified TERZAGI called PROGRES (acronym for PRObabilistic GRoundwater EquationS) was developed and verified against results from Monte Carlo simulations available from the literature.

28746 (LBL—12100, pp 25-30) **Numerical simulation of fractured porous media as multiple interacting continua.** Narasimhan, T.N. Jul 1981. NTIS, PC A12/MF A01. Order Number DE82000804.

In Earth Sciences Division annual report 1980.

The double-porosity concept has been extensively used to derive analytic solutions and numerical simulations. Recent examination of the partial differential equations governing the interacting continuum approach has indicated that this approach is indeed contained as a subset within the Integrated Finite-Difference Models (IFDM) currently used extensively in the Earth Sciences Division for isothermal and nonisothermal multiphase flows. Indeed, it appears that restating the interacting continua approach in terms of integrals rather than in the classical differential equation format not only leads to a much cleaner, simpler statement of the problem but also suggests the possibility of extending the idea to numerically viable multiple interacting continua. This report briefly summarizes the basic concepts involved and a few new results obtained with computer program TERZAGI.

28747 (LBL—12100, pp 46-47) **Chemical transport in natural systems.** Carnahan, C.L. Jul 1981. NTIS, PC A12/MF A01. Order Number DE82000804.

In Earth Sciences Division annual report 1980.

Work this year has focused on the study of steady-state mass transport in the presence of chemical reactions. In particular, one-dimensional, isothermal systems with constant values of chemical

potentials at the boundaries and one or two first-order, reversible chemical reactions were investigated. In the formalism of the thermodynamics of irreversible processes, the driving force for diffusional transport of a solute is the negative gradient of the chemical potential of the solute, and the driving force for a chemical reaction is the thermodynamic affinity, which is a linear function of the chemical potentials of the reaction's reactants and products. Mass flows are postulated to be linear functions of all gradients of chemical potentials. Thermodynamic coupling in such a system consists of contributions to the mass flow of a given solute arising from the gradients of the chemical potentials of other solutes. This approach allows study of mass transfer in time-invariant systems which are not in chemical equilibrium, in contrast to the classical approach which assumes equilibrium in all chemical reactions. It was found for the systems studied that in the presence of a chemical reaction the chemical potential distributions achieved configurations in the steady state such that the affinity of the reaction was driven toward zero to the largest extent possible within the confines of the system (assuming nonzero values of affinity at the boundaries).

28748 (NASA-TM—82166) The geology and geophysics of the Oslo Rift. Ruder, M.E. (National Aeronautics and Space Administration, Greenbelt, MD (USA). Goddard Space Flight Center). Jul 1981. 43p. NTIS, PC A03/MF A01.

The regional geology and geophysical characteristics of the Oslo graben are reviewed. The graben is part of a Permian age failed continental rift. Alkali olivine, tholeiitic, and monzonitic intrusives as well as basaltic lavas outline the extent of the graben. Geophysical evidence indicates that rifting activity covered a much greater area in Skagerrak Sea as well as the Paleozoic time, possibly including the northern Skagerrak Sea as well as the Oslo graben itself. Much of the surficial geologic characteristics in the southern part of the rift have since been eroded or covered by sedimentation. Geophysical data reveal a gravity maximum along the strike of the Oslo graben, local emplacements of magnetic material throughout the Skagerrak and the graben, and a slight mantle upward beneath the rift zone. Petrologic and geophysical maps which depict regional structure are included in the text. An extensive bibliography of pertinent literature published in English between 1960 and 1980 is also provided.

28749 (USGS—474-312) Geology of drill hole UE18t and Area 18, Timber Mountain Caldera Moat, Nevada Test Site. Byers, F.M. Jr.; Hawkins, W.L.; Muller, D.C. (Geological Survey, Denver, CO (USA); Los Alamos Scientific Lab., NM (USA)). Oct 1981. Contract AI08-76DP00474. 105p. NTIS, PC A06/MF A01. Order Number DE82004718.

Drill hole UE18t, located in the northeastern part of the Timber Mountain Caldera Moat (Area ft Nye County, Nevada, was sited to obtain chemical and physical data of the caldera-fill deposits and to extend knowledge of the geologic and hydrologic environment of the Nevada Test Site. Caldera-fill deposits in the area of subsidence related to eruption of the Rainier Mesa Member of the Timber Mountain Tuff (Tertiary) were penetrated to a depth of 1,635.0 ft (498.4 m), with the Rainier Mesa member extending below that depth to 2600.0 ft (792.5 m), the total depth of the drill hole. The caldera-fill deposits and the uppermost part of the Rainier Mesa are largely zeolitized and argillized tuffaceous rocks. The Ammonia Tanks Member from 945.0 to 1302.0 ft (288.0 to 396.8 m) is mostly unaltered welded tuff. Below 1889.7 ft (576.0 m), the Rainier Mesa is densely welded quartzo-feldspathic tuff with an average density of about 2.6 Mg/m^3, approaching that of granite. The static water level in UE18t has fluctuated within less than a foot (0.3 m) of 916 ft (279 m). The full suite of geophysical logs (caliper, density, resistivity, spontaneous potential, velocity, and neutron) from UE18t were interpreted and compared with physical properties measured on core. Cross-plot techniques were used to obtain additional properties of ash-flow tuffs below the water table. The log properties and cross plots indicate the quartzo-feldspathic tuffs of the Rainier Mesa Member have physical properties approaching those of granite. Correlation of log properties indicates the bedded tuffs above the Rainier Mesa Member and below the water table have very low permeability.

5802 Geophysics

REFER ALSO TO CITATION(S) 27663, 27895, 27915

28750 (LBL—12100, pp 60) Feasibility of shear wave vibrators for deep crustal studies. Coen, S. Jul 1981. NTIS, PC A12/MF A01. Order Number DE82000804.

In Earth Sciences Division annual report 1980.

The nonlinear inverse-scattering problem has been investigated for a shear wave source on the surface of the earth. The data consist of displacements of the surface measured as a function of time and are used to determine the elastic profile of the earth. The theory has direct applications in exploration seismology and solid-earth geophysics. The data may be provided by the solution of the forward-scattering problem for a known vibrator type and elastic profile of the earth.

5803 Mineralogy, Petrology, And Rock Mechanics

REFER ALSO TO CITATION(S) 27724, 27725, 27739

28751 (LBL—12100, pp 44-46) Thermodynamic properties of silicate liquids. Carmichael, I.S.E.; Ghiorso, M.S.; Moret, L.K.; Rivers, M.; Stebbins, J. Jul 1981. NTIS, PC A12/MF A01. Order Number DE82000804.

In Earth Sciences Division annual report 1980.

A solution model for a 17-component silicate liquid was formulated using experimental equilibria between solid solutions and silicate liquids as a function of pressure and temperature. Experimental results involving only two solid-solution series, the olivines and the plagioclase feldspars, were used to develop the solution model, but nevertheless it correctly showed that liquid immiscibility would be found in high SiO_2 liquid compositions and also in certain lunar lavas. It also predicted partial molar free energies of SiO_2 which were in close agreement with those calculated by other means. A series of measurements of the enthalpies and heat capacities of glasses and stable liquids in $NaAlSi_3O_8$ - $CaAl_2Si_2O_8$ system (abbreviated Ab - An) has been completed.

28752 (LBL—12100, pp 62-66) Evaluation of Nuclear Quadrupole Resonance (NQR) techniques for the in-situ measurement of stress/strain in salt. Schempp, E.; Klainer, S.M.; Hirschfeld, T. Jul 1981. NTIS, PC A12/MF A01. Order Number DE82000804.

In Earth Sciences Division annual report 1980.

The feasibility of Nuclear Quadrupole Resonance (NQR) is being examined for determining stress in rocks in-situ. The focus has been on determining strain in rock salt, NaCl. (ACR)

5804 Geochemistry

REFER ALSO TO CITATION(S) 27914, 28169

28753 (LBL—12100, pp 79-82) Iridium in spring waters and Summit Crater Lake of Mt. Hood, Oregon. Bowman, H.; Wollenberg, H.; Asaro, F.; Bowen, R.G. Jul 1981. NTIS, PC A12/MF A01. Order Number DE82000804.

In Earth Sciences Division annual report 1980.

Iridium, one of the platinum-group elements, has been detected for the first time in terrestrial water sources. During the hydrogeochemical study of Mt. Hood, Oregon, iridium was detected in the Summit Crater Lake and in both a warm and cold spring on the southern flank of the volcano. The seasonal variation (February to October) in iridium abundance was found to be quite large ($> 10^2$) in water from one of the warm spring orifices.

5805 Oceanography

REFER ALSO TO CITATION(S) 28184

64 PHYSICS RESEARCH

6401 Astrophysics And Cosmology

28754 (ESA-SP—162) Optical jets in galaxies. Battrick, B.; Mort, J. (comps.). (European Space Agency, 75 - Paris (France); European Southern Observatory, Garching (Germany, F.R.)). Mar 1981. 155p. (In French and English). NTIS PC A08/MF A01.

Optical, X-ray and radio observations of jets in quasars, radio galaxies and other extragalactic sources are presented. Imaging techniques applicable to Large Space Telescope data are discussed. Collimated outflow from various objects is considered. Models of jets are surveyed in light of recent observations.

28755 (NASA-TM—82101) Pks 2155-304 relativistically beamed synchrotron radiation from BL Lac object. Urry, C.M.; Mushotzky, R.F. (National Aeronautics and Space Administration, Greenbelt, MD (USA). Goddard Space Flight Center). Mar 1981. 32p. NTIS PC A03/MF A01.

The newly discovered BL Lacertae object, PKS 2155-304, was observed with the medium and high intensity energy detectors of the HEAO-1 A2 experiment. The variability by a factor of two in less than a day reported by Snyder, et al (1979) is confirmed. Two spectra, obtained a year apart, while the satellite was in scanning mode, are well fit by simple power laws with energy spectral index alpha sub 1 equals approximately 1.4. A third spectrum, of higher statistical quality, obtained while the satellite was pointed at its source, has two components. An acceptable fit was obtained using a two power law model, with indices alpha sub 1 equals 2.0 (+1.2, -0.6) and alpha sub 2 equals -1.5 (+1.5, -2.3). An interpretation of the overall spectrum from radio through X-rays in terms of a synchrotron self-Compton model gives a good description of the data if allowance is made for relativistic beaming. Thus, from a consideration of the spectrum, combined with an estimate of the size of the source, the presence of jets is inferred without their observation.

28756 (NASA-TM—82145) Cooling of young neutron stars and the Einstein x-ray observations. Nomoto, K.; Tsuruta, S. (National Aeronautics and Space Administration, Greenbelt, MD (USA). Goddard Space Flight Center). Jun 1981. 21p. NTIS PC A02/MF A01.

Cooling of neutron stars is calculated using an exact stellar evolution code. The full general relativistic version of the stellar structure equations are solved, with the best physical input available. For neutron stars with a stiff equation of state, it is found that the deviation from the isothermality in the interior is significant and that it takes at least a few thousand years to reach the isothermal state. By comparing theoretical and observational results, it is concluded that for Cas A, SN1006, and probably Tycho, standard cooling is inconsistent with the results from the Einstein Observatory, if neutron stars are assumed to be present in these objects. On the other hand, the detection points for RCW103 and the Crab are consistent with these theoretical results.

28757 (NASA-TM—82375) Distribution of hot stars and hydrogen in the Large Magellanic Cloud. Page, T.; Carruthers, G.R. (National Aeronautics and Space Administration, Houston, TX (USA). Lyndon B. Johnson Space Center). 1981. 52p. NTIS PC A04/MF A01.

Imagery of the Large Magellanic Cloud (LMC), in the wavelength ranges 1050 to 1600 A and 1250 to 1600 A, was obtained by the S201 far ultraviolet camera during the Apollo 16 mission. These images were reduced to absolute far-UV intensity distributions over the area of the LMC, with 3 to 5 arc min angular resolution. Comparison of these far-UV measurements in the LMC with H sub alpha and 21 cm surveys reveals that interstellar hydrogen in the LMC is often concentrated in 100 pc clouds within 500 pc clouds. Furthermore, at least 25 associations of O-B stars in the LMC are outside the interstellar hydrogen clouds four of them appear to be on the far side. Far-UV and mid-UV spectra were obtained of stars in 12 of these associations, using the International Ultraviolet Explorer. Equivalent widths of L alpha and six other lines, and relative intensities of the continuum at seven wavelength from 1300 A to 2900 A, were measured. These spectra are also discussed.

28758 (NASA-TM—82376) S201 catalog of far-ultraviolet objects. Page, T.; Carruthers, G.R.; Heckathorn, H.M. (National Aeronautics and Space Administration, Houston, TX (USA). Lyndon B. Johnson Space Center; Naval Research Lab., Washington, DC (USA)). 1981. 151p. NTIS PC A08/MF A01.

The results of analysis of the images of stars and other discrete objects obtained from the lunar based far ultraviolet camera/spectrograph (experiment S201) are presented. The brightnesses of all objects are placed on an absolute scale of UV magnitudes based on instrument preflight calibrations. These magnitudes are compared with expectations based on stellar model atmosphere flux distributions, and with those obtained from calibrated OAO-2 observations. The data reduction programs are also described.

28759 (PB—81-804072) Quasars, pulsars, and black holes. 1964-January 1981 (citations from the NTIS Data Base). Report for 1964-Jan 1981. (National Technical Information Service, Springfield, VA (USA)). Feb 1981. 313p. NTIS PC N01/MF N01.

Astronomical studies of quasars, pulsars, and black holes are cited. Computer simulations, mathematical models, and other methods used for the verification of hypotheses about astrophysical processes are included. (This updated bibliography contains 306 citations, 39 of which are new entries to the previous edition.)

28760 (PB—81-857179) Blackbody radiation. January 1970-December 1980 (citations from the Searchable Physics Information Notices Data Base). Report for Jan 1970-Dec 1980. (New England Research Application Center, Storrs, CT (USA)). Jan 1981. 100p. NTIS PC N01/MF N01.

This retrospective bibliography contains citations concerning the detection, measurement, analysis, and interpretation of blackbody radiation from various sources ranging from black holes to stellar objects to blackbody cavities. Theoretical and experimental considerations and some attention to simulation are included. (Contains 100 citations, fully indexed and including a table of contents.)

28761 (PB—81-858342) Astrophysical Balmer emission lines. January 1970-December 1980 (citations from the Searchable Physics Information Notices Data Base). Report for Jan 1970-Dec 1980. (New England Research Application Center, Storrs, CT (USA)). Jan 1981. 187p. NTIS PC N01/MF N01.

This retrospective bibliography contains citations concerning observations, analyses, and interpretations of Balmer emission lines from supernova remnants, cosmic gases, planetary nebulae, and from various types of galaxies, stars (including the sun), and quasi-stellar objects. Consideration is also given to Balmer lines in synthesizing spectral features for star models. (Contains 171 citations, fully indexed and including a table of contents.)

28762 (PB—81-858953) Cassiopeiae. January 1970-December 1980 (citations from the Searchable Physics Information Notices Data Base). Report for Jan 1970-Dec 1980. (New England Research Application Center, Storrs, CT (USA)). Jan 1981. 85p. NTIS PC N01/MF N01.

This retrospective bibliography contains citations concerning observations, analyses, and interpretations of electromagnetic and gas emissions from Cassiopeiae. The nature of the sources and the properties and effects of the propagation media are considered both theoretically and mathematically. (Contains 85 citations, fully indexed and including a table of contents.)

28763 Symbiotic star CI Cygni: S-process episode or accretion event. Kenyon, S.J.; Webbink, R.F.; Gallagher, J.S.; Truran, J.W. *Astronomy and Astrophysics;* **106**: No. 1, 109-111(Feb 1982).

Evidence that the symbiotic star C I Cygni is an eclipsing binary is reviewed. It is shown that the s-process episode described by Audouze et al. (1981) during its 1975 outburst arises from super-

position of normal gM4 absorption features on the continuum of the hot component during eclipse ingress, and not to sudden enhancements of rare earth elements. The peculiar velocity displacements of absorption lines with different excitation potentials during this episode are identified as signatures of an optically thick accretion disk, which dominates the visible spectrum during outburst. The data presented by Audouze et al., and the shape of the light curve thus provide evidence that the outburst is accretion-powered.

28764 **Hard x-rays emission (15 to 150 keV) from the region of 4UO515 + 38.** Ubertini, P.; Bazzano, A.; La Padula, C.D.; Polcaro, V.F. *Astronomy and Astrophysics;* **106**: No. 1, 174-175(Feb 1982).

We report the observation of a new hard x-rays source located at RA 5/sup h/ 16/sup m/ and declination 38° emitting in the range 15 to 150 keV.

28765 **Baryon number creation and phase transitions in the early universe.** Hut, P.; Klinkhammer, F.R. *Astronomy and Astrophysics;* **106**: No. 2, 245-253(Feb 1982).

We aim at a consistent scenario for the generation of the baryon-antibaryon asymmetry in the early Universe. First we discuss recent calculations using unified interactions, especially how the required CP violation can be provided for. Secondarily we consider finite temperature effects, namely the existence of phase transitions, i.e., changes in gauge symmetries in a cooling Universe. Although the expansion of the Universe can be affected significantly, the final baryon number is surprisingly insensitive to the nature of the phase transition, as numerically calculated in a simple model. Also we briefly discuss problems with monopole production and the generation of the density perturbations required for galaxy formation.

28766 **Large-scale distribution of galactic gamma radiation observed by COS-B.** Hermsen, W.; Bignami, G.F.; Caraveo, P.A.; Buccheri, R.; Mayer-Hasselwander, H.A.; Kanbach, G.; Lebrun, F.; Masnou, J.L.; Lichti, G.G. *Astronomy and Astrophysics;* **105**: No. 1, 164-175(Jan 1982).

A complete survey of the Galaxy in high-energy gamma rays has been performed with the experiment aboard the ESA satellite COS-B. Gamma-ray sky maps for energy ranges between 70 MeV and 5 GeV were derived from 4 yr of observations and are presented as contour maps and as longitude and latitude profiles for three energy intervals. The latitude extent of the radiation observed toward the inner Galaxy is resolved and an intrinsic width of approximately 1° is indicated. Correlations between features of the gamma-ray sky maps and known galactic constituents are evident on the large (several kpc), medium (1-3 kpc) and the small (approx. < = 1 kpc) scale, and reveal the grand design of the Milky Way, galactic arms as in Perseus and Carina, giant molecular clouds and local features like Gould's Belt.

28767 **Fast neutron capture on ^{180}Hf and ^{184}W and the solar hafnium and tungsten abundance.** Beer, H.; Kaeppeler, F.; Wisshak, K. *Astronomy and Astrophysics;* **105**: No. 2, 270-277(Jan 1982).

The capture cross section of ^{180}Hf and ^{184}W were measured by the activation method and via direct detection of prompt gamma-rays, respectively. The Maxwellian averaged cross sections for kT = 30 keV were used to decompose the solar isotopic Hf- and W-abundances into s- und r-process contributions. Examination of the r-process contributions provided evidence that the abundances of Hf and W might be smaller than quoted in recent abundance compilations. Therefore it is proposed to reconsider the information from meteorite analyses and to perform new measurements if necessary.

28768 **Some extreme metal-deficient giants.** Bartkevicius, A.; Straizys, V. *Astronomy and Astrophysics;* **104**: No. 2, 215-217(Dec 1981).

The temperatures, metallicities, and color excesses of five giants with extreme metal-deficiency are discussed. Their observations in the Vilnius photometric system after correction for interstellar reddening yield the following (Fe/H) values: -3.0 for BD -18°5550 and HD4306. -2.8 for CD -25°13871 and HD 115444, and -2.6 for HD 126587. Their effective temperatures are within 4800 to 4950 K.

28769 **Frequency dependence of micropulse separation.** Gil, J. *Astronomy and Astrophysics;* **104**: No. 1, 69-71(Dec 1981).

It is demonstrated that within an angular beaming model of microstructure, the longitude of micropulses should be independent of frequency, whereas the component separation can vary in the frequency band in which the micropulses are visible.

28770 **Distribution of pulsars in the galactic plane.** del Romero, A.; Gomez-Gonzales, J. *Astronomy and Astrophysics;* **104**: No. 1, 83-87(Dec 1981).

The spatial distribution of the projections of pulsars on the galactic plane within distances less than 5 kpc has been studied by looking for a correlation of these objects with the projections of the H II regions of best known distances. A significant correlation appears when pulsar distances are calculated from the dispersion measures by using a mean interstellar electron density <n/sub e/> = 0.03 cm^{-3}, taken as uniform within the solar neighborhood considered. This correlation remains for models in which the electron density increases toward the galactic center. The resulting spatial correlation of pulsars with the galactic spiral arms in the vicinity of the Sun indicates that pulsars are generated from young objects, and allows us to estimate an upper limit for their mean lifetimes, which is in agreement with previous values.

28771 **New analysis of the pulsar distribution in the galaxy.** Morini, M. *Astronomy and Astrophysics;* **104**: No. 1, 75-79(Dec 1981).

As discussed here it is difficult to derive the properties of the distribution of pulsars in the Galaxy from the current observations. In this work I present some Monte-Carlo simulations of the pulsar observations starting from proposed galactic distributions, showing that the best fit is obtained with a small number of pulsars (N/sub p/ approx. equal to 3600) with a rather flat galactocentric distribution and a high average luminosity. A large pulsar population concentrated in the inner part of the galaxy as proposed by Taylor and Manchester (1977) could agree with the observations only if selection effects bias the surveys more than we expect.

28772 **Hydrogen line spectrum in quasars. Part 1. Approximation procedures for line transfer versus an exact treatment.** Collin-Souffrin, S.; Delache, P.; Frisch, H.; Dumont, S. *Astronomy and Astrophysics;* **104**: No. 2, 264-275(Dec 1981).

Approximation procedures frequently used to handle self-absorption effects in hydrogen emission lines of quasars are discussed and compared to an exact numerical treatment of line transfer. The model used is a finite slab with prescribed density and temperature. The major conclusions concern the local escape probability approximation. In its usual semi-infinite version, photons are allowed to escape from one side of the medium only. This can overestimate the subordinate line fluxes by factors up to an order of magnitude. It can also underestimate the intensity ratio of Hα to Hβ line by substantial factors. A modified version, introduced in this paper, in which finiteness effects are incorporated yields much more accurate line ratios and line fluxes. Finally, natural broadening effects (representable by a Voigt profile) are important in subordinate lines.

28773 **Attempt to determine the solar Ly α flux independently of instrument calibration.** Cazes, S.; Emerich, C.; Vidal-Madjar, A.; Meier, R.R. *Astronomy and Astrophysics;* **104**: No. 1, 10-14(Dec 1981).

From comparison of geocoronal absorption of the Ly α interplanetary emission profiles observed from 500 km in two directions perpendicular to the ecliptic plane, the ratio μ between Ly α radiation pressure and solar gravitation is deduced independently from absolute calibration, and found to be equal to 0.62 +- 0.18, for the April 1971 period. This determination provides an absolute value for the solar Ly α flux at the center of the line allowing an increase in accuracy by a factor of two of the corresponding OSO 5 measurements.

28774 **Correlation between bandwidth and frequency drift velocity of intermediate drift bursts.** Elgaroy, O.; Soldal, O. *Astronomy and Astrophysics;* **104**: No. 1, 99-100(Dec 1981).

Bandwidth and frequency drift velocity has been measured on intermediate drift bursts observed at Oslo Solar Observatory. The two quantities are correlated. Possible implications of this finding are discussed.

28775 **Propagation of waves in an atmosphere in the presence of a magnetic field. Part 4. Alfven waves in sunspot umbrae.** Bel, N.; Leroy, B. *Astronomy and Astrophysics;* **104**: No. 2, 203-206(Dec 1981).

The propagation of Alfven waves in a sunspot is studied without resort to the eikonal approximation. We find that the outgoing energy flux density reaching the corona is less than 10^{-5} of the input energy flux density. This clearly shows that the cooling of sunspots by ascending Alfve n waves is not possible.

28776 **Analysis of solar limb observations.** Wiesmeier, A.; Durrant, C.J. *Astronomy and Astrophysics;* **104**: No. 2, 207-210(Dec 1981).

We derive expressions for the correction of the statistical properties of two-dimensional fields degraded by arbitrary (without axial symmetry) point-spread functions. We treat both one- and two-dimensional sampling. Several earlier estimates of corrections to observations of brightness and velocity fluctuations away from the centre of the solar disk are shown to be in error. Corrected values of the rms granular brightness fluctuations as a function of heliocentric angle are reported.

28777 **Analysis of solar limb observations. Part 2. Geometrical smearing.** Durrant, C.J.; Kneer, F.; Maluck, G. *Astronomy and Astrophysics;* **104**: No. 2, 211-214(Dec 1981).

Center-of-disk and limb observations of photospheric brightness fluctuations demonstrate a systematic suppression of the values at the limb. This is a geometrical effect due to the line of sight at the limb passing through various structures across the surface. We look at this effect in the light of recent granular temperature models using a simple model incorporating the dominant granular scale. We find the geometry to have little influence on the deep-seated granular brightness field but to strongly suppress the brightness fluctuations due to the upper photospheric temperature field. We discuss the significance of these results for the restoration of limb observations.

28778 **Spectral and polarization characteristics of the supernova remnant CT A1.** Sieber, W.; Salter, C.J.; Mayer, C.J. *Astronomy and Astrophysics;* **103**: No. 2, 393-404(Nov 1981).

The spectral characteristics of the continuum emission from the supernova remnant CTA 1 have been studied over the frequency range from 151.5 to 2695 MHz. A point-by-point analysis of the spectral index shows that there exist only small deviations from the mean value $<\alpha> = 0.47$ (S approx. equal to ν^{-}/sup α/). Polarization measurements at 2695 and 1720 MHZ indicate a magnetic field which is tangential to the shell at those places where shell structure is well defined. The physical parameters of the remnant including possible x-ray emission are discussed as are the characteristics of some point sources in the field.

28779 **Point radio source in the supernova remnant G78.2 + 2.1.** Higgs, L.A.; Roger, R.S.; Landecker, T.L.; Spangler, S.R.; Cordes, J.M.; Dickey, J.M. *Astronomy and Astrophysics;* **103**: No. 2, 370-373(Nov 1981).

Observations of a point source, 2020 + 401, in the eastern rim of the supernova remnant G 78.2 + 2.1 have been made at 20 cm, 6 cm, and 2 cm using the Very Large Array. This source was previously thought to be variable, but no variability was detected over a two-month time interval. The radio properties of the source give no reason to associate it with the supernova remnant. It is a point source (< 0. 05) and has a spectrum typical of many quasars, and is therefore probably a background extragalactic source. Two other small-diameter sources within the remnant are possibly related to it. However, the number of such sources found is consistent with extragalactic source counts.

28780 **Stability of the pulse intensity of the x-ray pulsar in the Crab Nebula.** Meidav, M.; Sadeh, D. *Astronomy and Astrophysics;* **103**: No. 2, 367-370(Nov 1981).

The large area detector on the HEAO - A satellite and the fast time resolution, permitted us to detect individual Crab pulses. A statistical analysis performed on those pulses show, that although they are pulse-to-pulse variations, they fall within the random expectation.

28781 **Pulsar altitude distribution as a clue to their mean velocity and lifetime.** Arnaud, M.; Rothenflug, R. *Astronomy and Astrophysics;* **103**: No. 2, 263-268(Nov 1981).

The pulsar altitude distribution in the galaxy depends on: (1) the gravitational field, (2) the pulsar lifetime tau; the pulsar creation rate is assumed to be constant in time, (3) the pulsar initial velocity distribution and the corresponding mean value < vertical stroke V/sub z/ vertical stroke >, (4) the altitude distribution of the pulsar progenitors, characterized by their scale-height H_0. In this paper we compute the pulsar altitude distributions in a model including all the above ingredients and using as parameters < vertical stroke V/sub z/> vertical stroke, tau, and H_0.

28782 **Collapse of rotating stellar cores.** Mueller, E.; Hillebrandt, W. *Astronomy and Astrophysics;* **103**: No. 2, 358-366(Nov 1981).

The collapse of the rotating cores of massive stars (M > = 15M/sub sun/) is considered. The dynamical evolution of the core is followed by an explicit two-dimensional hydrodynamic code. A realistic, finite-temperature equation of state is used in the calculations. Rigidly and differentially rotating initial models are both studied. We find that in all cases considered the collapse proceeds up to nearly nuclear matter density before it is stopped. In none of the examined models is the core-bounce followed by an explosion. The dynamical behaviour of the slowly rotating models is very similar to that of non-rotating models. The rapidly rotating cores already show large non-spherical effects before core bounce. In these models, a high entropy blob is formed near the axis of rotation, which, while trying to rise and expand, is rapidly destroyed by the onset of circulation. A flattened, nearly hydrostatic central condensation builds up with relatively low central density (Q approx. equal to 5 10^{13} g cm^{-3}) on which the matter of the envelope is further accreted.

28783 **Horseshoe periodic orbits in the restricted problem of three bodies for a Sun-Jupiter mass ratio.** Taylor, D.B. *Astronomy and Astrophysics;* **103**: No. 2, 288-294(Nov 1981).

Segments of seven families of symmetric horseshoe periodic orbits of the restricted three body problem for a Sun-Jupiter mass ratio have been numerically determined. Each family is found to have a region consisting of smooth horseshoe shaped orbits with the family evolving to orbits acquiring loops on both sides of the smooth horseshoes. The general evolution of these families is discussed and one in particular (Rabe's horseshoe is a member of this family) is described in more detail with the aid of computer plots of orbits in this family. The smooth horseshoes do not continuously evolve along one family but are members of many distinct families. The change in shape of the smooth horseshoe orbits is examined as they have closer approaches to Jupiter. Each family has a bifuraction with an asymmetric family of periodic orbits. The initial conditions and other quantities describing these bifurcation orbits are given. Starting from these orbits the initial segments of the asymmetric families has been determined. Conjectures are given on the termination of the symmetric families and the existence of other horseshoe families. Some possible physical applications that the smooth horseshoe orbits may have are briefly discussed.

28784 **Solar wind motion within 30 R/sub sun/: spacecraft radio scintillation observations.** Armstrong, J.W.; Woo, R. *Astronomy and Astrophysics;* **103**: No. 2, 415-421(Nov 1981).

We report here new remote-sensing observations of the solar wind motion within about. 30 R/sub sun/, using multiple-station intensity scintillations of spacecraft signals. The spacecraft used in this study were the Viking orbiters and Helios A/B; the observations were taken in the ecliptic plane. Using a model of the scintillation diffraction pattern that allows estimates of both mean and 'random' solar wind speeds, we find the following. (1) The mean speed increases with distance from the Sun in a way that is consist-

ent with earlier near-sun scintillation observations using natural radio sources. (2) The random velocity is a significant fraction of the mean for R < 20 R/sub sun/. (3) The elongation range where large fractional random velocities are observed corresponds to the range where we measure substantial evolution of the solar wind density spectrum. (As the line of sight passes closer to the Sun than 20 R/sub sun/ the spectrum for wavenumbers 10^{-9} - 10^{-7} m^{-1} becomes flatter and the fractional velocity fluctuations become larger.) We also report here some very accurately normalized point-source scintillation indices showing the expected saturation at unity as the strength of scattering becomes large.

28785 **Measurements of the equivalent width of the H/sub β/ emission line and age determination of H II regions of the LMC and SMC.** Dottori, H.A.; Bica, E.L.D. *Astronomy and Astrophysics;* **102**: No. 2, 245-249(Oct 1981).

The equivalent width of the emission line H/sub β/ was measured photoelectrically in 29 H II regions of the LMC and 2 of the SMC, respectively. The age of these regions was obtained trough a calibration of W/sub Hβ/. A relation was found between W/sub Hβ/ and the ratio of the H II region radius to that of the embedded stellar association.

28786 **IUE spectroscopy of cataclysmic variables.** Krautter, J.; Vogt, N.; Klare, G.; Wolf, B.; Duerbeck, H.W.; Rahe, J.; Wargau, W. *Astronomy and Astrophysics;* **102**: No. 1, 337-346(Sep 1981).

Spectra of the classical novae V 603 Aql, HR Del, and RRPic, the recurrent nova TCrB, the dwarf nova RUPeg, and the peculiar object TT Ari, obtained with the IUE in the range 1150 to 3200 Angstroem, are presented. Based on the continuum fluxes, we determined interstellar extinction values and temperatures in the range of 25,000 to 45,000 K. The energy distribution was compared with optically thick steady state accretion disk models. The spectra of all variables (except for TT Ari) are characterized by strong emission features of highly ionized and/or highly excited ions of N, C, Si, Al, and He. TCrB and RUPeg show, in addition, the strong Mg II h+k resonance doublet in emission. The old novae exhibit pronounced P Cygni characteristics. TT Ari shows most of the above mentioned lines in broad absorption or with slight P Cygni characteristics resembling the spectrum of a dwarf nova in outburst. From the P Cygni profiles of the unresolved C IV doublet mass loss rates were derived for HR Del ($M = 2.610^{-11}$ m/sub sun/ yr^{-1}) and for TT Ari ($M = 4.810^{-11}$ M/sub sun/ yr^{-1}). Our uv observations of the line spectrum and continuum fluxes agree well with the properties of theoretical accretion disk models of cataclysmic binaries.

28787 **Analysis of the pulse profiles of the binary x-ray pulsars.** Wang, Y.M.; Welter, G.L. *Astronomy and Astrophysics;* **102**: No. 1, 97-100(Sep 1981).

The pulse profiles of the majority of the known binary X-ray pulsars are analyzed in an attempt to drive information about the beaming geometries and the structure of the plasma magnetosphere. Evidence for a bias of the magnetic and rotation axes of the underlying neutron stars toward alignment is presented. The light curves of some of the slow, less luminous pulsars can be modelled on the basis of broad, isotropically-emitting hot spots, implying rather ineffective channelling of the accreting plasma by the magnetic field. On the other hand, (in general non-axisymmetric) fan-beam geometries are required for most of the faster and/or more luminous sources, consistent with the presence of a Thomson-opaque accretion funnel at each magnetic pole. Geometrical effects such as the eclipse of the fan beam by the stellar surface and the intersection of the beams from the opposite poles can produce very sharp features in the X-ray light curves. Finally, the physical origins of spectral variations in the pulse profiles are briefly discussed.

28788 **Mild abundance gradient of NGC 1365.** Alloin, D.; Edmunds, M.G.; Lindblad, P.O.; Pagel, B.E.J. *Astronomy and Astrophysics;* **101**: No. 3, 377-384(Sep 1981).

ESO and AAT observations are combined so as to estimate O and N abundances of thirteen H II regions in the nuclear region, bar and arms of the barred spiral, hot-spot galaxy NGC 1365 which has recently been found to have a Seyfert nucleus. In agreement with an earlier result based on a smaller data sample, the radial abundance gradient is quite small. The behavior of NGC 1365 in this respect is compared with that of a few other galaxies of similar morphological type but without a bar.

28789 **M giants in the nuclear bulge of the Galaxy.** Frogel, J.A. (Cerro Tololo Inter-American Observatory, La Serena (Chile)). pp 63-69 of Physical processes in red giants. Iben, I. Jr. (Illinois Univ., Urbana (USA)); Renzini, A. (Bologna Univ. (Italy)) (eds.). Dordrecht, Netherlands; D. Reidel (1981).

From 2. workshop in astrophysics; Erice, Sicily, Italy (3 Sep 1980).

That the nuclear bulge of our galaxy contains a large population of M giants has been known for over twenty years. The author has observed a sample of late M giants in the infrared in order to first of all find out what characteristics of these stars, which are relatively rare in the solar neighborhood, are, and secondly, to see if the problem of stellar synthesis models could be resolved. Here he restricts himself to a presentation of the infrared data only insofar as they relate to the bolometric luminosities of the stars.

28790 **Correlation between x-ray and high energy gamma-ray emission form Cygnus X-3.** Weekes, T.C.; Danaher, S.; Fegan, D.J.; Porter, N.A. *Astronomy and Astrophysics;* **104**: No. 1, L4-L6(1981).

In May-June 1980, the 4.8 hour modulated x-ray flux from Cygnus X-3 underwent a significant change in the shape of the light curve; this change correlates with the peak in the high-energy ($E > 2 \times 10^{12}$ eV) gamma ray emission at the same epoch.

6402 Atmospheric Physics

28791 **(NASA-TM—80763) Cusp region particle precipitation and ion convection for northward interplanetary magnetic field.** Burch, J.L. (Southwest Research Inst., San Antonio, Texas); Reiff, P.H. (Rice Univ.); Spiro, R.W. (Rice Univ.); Heelis, R.A. (Texas Univ. at Dallas, Richardson); Fields, S.A. (National Aeronautics and Space Administration, Huntsville, AL (USA). George C. Marshall Space Flight Center). 1981. 12p. NTIS PC A02/MF A01.

Data from Atmosphere Explorer D for periods of strong northward interplanetary magnetic field are discussed. In the dayside magnetospheric cusp region energy time spectrograms of suprathermal positive ion fluxes exhibit a characteristic 'V' pattern as the spacecraft moves toward higher latitudes that is, with the peak in the energy spectrum falling in energy and then rising again. Convection velocities follow this pattern closely with strong eastwest flows (with antisunward components) occurring in the equatorward half of the 'V' and significant sunward flows occurring in the poleward half of the 'V'. These patterns can be understood qualitatively in terms of a model of ionospheric electric potential produced by the known dependence of Birkeland current densities on magnetic activity.

28792 **(PB—81-859696) Magnetospheric resonances. January 1972-January 1981 (citations from the International Aerospace Abstracts Data Base). Report for Jan 1972-Jan 1981.** (New England Research Application Center, Storrs, CT (USA)). Feb 1981. 104p. NTIS PC N01/MF N01.

This retrospective bibliography contains citations concerning theories, investigations, and analyses of the resonance properties and resonant phenomena of the terrestrial magnetosphere resulting from magnetospheric configurations, from particle and plasma motions, and from propagating magnetoacoustic and magnetohydrodynamic waves. Various resonance mechanisms and interactions are considered. (Contains 101 citations, fully indexed and including a table of contents.)

6403 Atomic, Molecular, And Chemical Physics

REFER ALSO TO CITATION(S) 28274, 28904, 28920

28793 **(DESY-SR—80/17) Dynamics of localized excitations from energy and time resolved spectroscopy.** Schwentner, N. (Kiel Univ. (Germany, F.R.). Inst. fuer Experimentalphysik). Oct 1980. 27p. Fachinformationszentrum Energie, Physik, Mathematik, Karlsruhe, Germany, F.R.

The electronic structure and the excited state relaxation phenomena in condensed rare gases have been studied by absorption spectroscopy, photoelectron spectroscopy and time resolved luminescence spectroscopy all using selctive excitation by monochromatized synchrotron radiation. Radiationless and radiative electronic transitions in excited states and the rearrangement of surrounding matrix atoms will be discussed for excited rare gas atoms in rare gas matrices. Furthermore, experimental results concerning the scattering of excitons within the free exciton branches, localization of excitons, relaxation within the selftrapped exciton states and energy transfer to guest atoms and boundaries will be presented.

28794 **(DOE/ER/04676—T1) Atomic and molecular sciences. Progress report No. 8, April 1, 1981-March 31, 1982.** Walters, G.K.; Lane, N.F. (Rice Univ., Houston, TX (USA). Dept. of Physics). 1981. Contract AS05-76ER04676. 46p. NTIS, PC A03/MF A01. Order Number DE82004613.

The atomic and molecular physics program at Rice University addresses fundamental problems in structure, radiation-induced gas- and condensed-phase reaction kinetics and dynamics, and the mutual interactions of radiation, atoms, molecules, electrons and ions, particularly in highly unusual or exotic environments. The program emphasizes fundamental studies relating to new sources of energy, with close interaction between experimental and theoretical aspects of the research. Progress in the experimental program is reported in two principal areas, A) time resolved spectroscopy, and B) reactions in a flowing helium afterglow.

28795 (GSI—81-1, pp 149-156) **Electron capture collisions at keV energies.** Bliman, S.; Dousson, S.; Geller, R.; Jacquot, B.; van Houtte, D. Jan 1981. Dep. NTIS (US Sales Only).

From 2. international workshop on multiply charge electron resonance ion sources; Darmstadt, F.R. Germany (8 Dec 1980).

28796 (GSI—81-1, pp 182-184) **Electron-capture, electron-loss and impact-ionization cross sections for 103- to 3400-keV/amu multi-charged iron ions colliding with molecular hydrogen.** Berkner, K.H.; Graham, W.G.; Pyle, R.V.; Schlachter, H.S.; Stearns, J.W. Jan 1981. Dep. NTIS (US Sales Only).

From 2. international workshop on multiply charge electron resonance ion sources; Darmstadt, F.R. Germany (8 Dec 1980).

We report cross-section measurements for collisions of multicharged iron ions with a molecular hydrogen target: a) electron-capture and -loss of the multi-charged ions, and b) impact ionization of the hydrogen target. Iron ions, Fe^{+}sup(q), were used with charge states q = 3-13 at 103 keV/amu, q = 9-16 at 294 keV/amu, q = 11-22 at 1160 keV/amu, and q = 20-25 at 3400 keV/amu. We find that an empirically determined expression for the electron-capture cross section, sigma = (1.2×10^{-8}) q^{3}sup(.)^{15} E(keV/amu)$^{-4}$sup(.)^{48} cm^{2}/molecule, describes all the data at and above 275 keV/amu. These measurements are compared with recent theoretical calculations.

28797 (GSI—81-1, pp 185-188) **Collisions of highly stripped ions at MeV energies in gas targets. Charge transfer and ionization.** Schlachter, A.S. Jan 1981. Dep. NTIS (US Sales Only).

From 2. international workshop on multiply charge electron resonance ion sources; Darmstadt, F.R. Germany (8 Dec 1980).

We have measured cross sections for charge transfer and ionization in H_2 and rare-gas targets by fast, highly ionized carbon, iron, niobium, and lead ions in charge states $^{+}3$ to $^{+}59$, with energies in the range 0.1-4.8 MeV/amu. Experimental results are compared with classical-trajectory calculations; agreement is generally good. For a given target, the cross sections for net ionization reduce to a common curve when plotted as cross section divided by charge state versus energy per nucleon divided by charge state.

28798 **(PB—81-858961) Born approximation in electron collisions. January 1970-December 1980 (citations from the Searchable Physics Information Notices Data Base). Report for Jan 1970-Dec 1980.** (New England Research Application Center, Storrs, CT (USA)). Jan 1981. 89p. NTIS PC N01/MF N01.

This retrospective bibliography contains citations concerning the Born Approximation in theoretical and experimental studies and analyses of the collisions of electrons with atoms, ions, and molecules. Interaction cross sections, excitation, ionization, emissions, and elastic and inelastic scattering are considered for the various types of electron collisions. (Contains 80 citations, fully indexed and including a table of contents.)

28799 (PNL—4100-Pt.4, pp 21-29) **Initial interaction process.** Feb 1982. NTIS, PC A06/MF A01.

In Pacific Northwest Laboratory annual report for 1981 to the DOE Office of Energy Research. Part 4. Physical sciences.

Our study of the initial interaction processes in the absorption of energy from a radiation field by biologically significant material has concentrated on the measurement and interpretation of total and differential cross sections for the production of electrons and ions in collisions of fast charged particles with atomic and molecular targets. Of particular interest is the determination of cross section systematics and interaction mechanisms which will enable extrapolation of experimental results into regions where experiments are either impractical or unfeasible. Measurements were initiated to provide information on the degree of multiple ionization which occurs in ionizing collisions. Interpretation of collision cross section in terms of current theory has concentrated on application of Born theory to doubly differential cross sections of ionization of neon by fast protons and to application of Bethe-Born theory to singly differential cross sections measured for H+- Ne collisions. The latter is particularily important in devising means of extrapolating and interpolating cross sections into regions where data do not exist.

28800 (PNL—4100-Pt.4, pp 31-34) **Track strucuture.** Feb 1982. NTIS, PC A06/MF A01.

In Pacific Northwest Laboratory annual report for 1981 to the DOE Office of Energy Research. Part 4. Physical sciences.

Experimental determinations of radiation interactions in small absorber sites is limited to volumes greater than about 0.1 μm. This restriction has encouraged the development of computational methods to obtain the desired information in sites of arbitrary size. Monte Carlo codes are being developed to calculate ionization and energy imparted in submicron sites by energetic charged particles. These codes draw on extensive data for electron production in electron- and ion-molecule collisions as the source term for energy degradation calculations. The systematics of molecular cross sections are studied for the information on how molecular structure affects energy deposition calculations. The reliability of calculations that use gas-phase cross sections to determine energy transport in the condensed phase are being assessed.

28801 **Computation of Fourier transform of a general two-centre STO charge distribution.** Junker, B.R. (Oak Ridge National Lab., TN (USA)). *Computer Physics Communications;* **23**: No. 4, 377-384(Aug 1981).

The computation of the charge transfer amplitude at energies greater than a few KeV's requires the computation of two-centre integrals of the form of Fourier transforms. Similar integrals arise in the Bethe theory of the scattering of charged unstructured particles by molecules and in the computation of the coherent and incoherent intensities of X-rays scattered by molecules. This program provides a means of computing these integrals for an arbitrary Slater Type Orbital (STO) basis.

6404 Fluid Physics

28802 (INIS-SU—59, pp 12-19) **Pulsation development in a flow behind a turbulator. Part 1. Models of vortex structure in a flow with transverse shift.** Kokorev, L.S.; Kostyunin, B.N.; Shelagin, Yu.N. 1980. (In Russian). Dep. NTIS (US Sales Only).

In Thermophysical problems in nuclear reactors. Issue 9. Experimental and calculation technique.

Models of vortex motion in turbulent liquid coolant flow with transverse shift are investigated. Equations, describing circulation of the vortex disturbance rate and time changes in elliptical vortex parameters are obtained. Formulae for determination of the vortex kinetic energy per unit of its length and the vortex critical Reynolds number are given. Comparison of the critical Reynolds number values for two types of vortex motion plane and three-dimensional shows that the three-dimensional vortex the axis of which is orientated in the direction of midddle flow is less stable, and therefore, it is more probable to occur. It is concluded that a single vortex transfers its energy in the process of its development after the state with maximal kinetic energy not only to the small-scale component of motion but to the averaged motion as well. That is why the vortex motion is, in principle, the pulsatory one, and the conditions of energy balance are achieved only in the mean for a certain set of developing and decaying vortices. Vortex decay following its energy increase phase is a characterictic peculiarity of turbulent flow observed experimentally in the form of "overswings".

28803 (INIS-SU—59, pp 20-24) **Pulsation development in a flow behind a turbulator. Part 2. Calculational model of pulsation development.** Kokorev, L.S.; Kostyunin, B.N.; Shelagin, Yu.N. 1980. (In Russian). Dep. NTIS (US Sales Only).

In Thermophysical problems in nuclear reactors. Issue 9. Experimental and calculation technique.

A simplified mathematical model, describing development of pulsation motion in the coolant flow behind a turbulator is suggested. Mechanical energy equations for averaged and pulsatory motion are obtained. It is shown that the obtained set of equations describes energy transfer from averaged motion to pulsatory one with the following degeneration of pulsation energy. It is concluded that the suggested calculational model satisfactorily describes the distribution of pulsation intensity in a channel at large distances from the turbulator.

28804 **(PB—81-146805) Wall emission dominated discharge channel.** Cohen, I.M. (Pennsylvania Univ., Philadelphia (USA). Dept. of Mechanical Engineering and Applied Mechanics). May 1980. 24p. NTIS, PC A02/MF A01.

Diffusion of ions and electrons through a uniform neutral gas was studied under complete wall emission-absorption boundary conditions to understand more clearly the role of emitting and absorbing electrodes in MHD type channel flows. All other effects including temperature gradients, volumetric ionization, and recombination processes were ignored to obtain a closed form exact solution for charged and seed neutral particle densities and a self-consistent electric field. From these solutions, current-voltage characteristics of the discharge channel were calculated and found to have the form of ordinary ionization chamber characteristics. For small Debye length, cathode and anode space charge sheaths had exponential density profiles indicating that the densities were in equilibrium with the self-consistent electric field. Electron densities near the cathode were extremely high due to thermionic emission, and ion densities were elevated above quasi-neutral regime values in the anode sheath. Electric current between electrodes increased rapidly at first, then saturated with increasing voltage between them.

28805 **Use of artificial viscosity in multidimensional fluid dynamic calculations.** Wilkins, M.L. *Journal of Computational Physics;* **36**: No. 3, 281-303(15 Jul 1980). Contract W-7405-ENG-48.

The von Neumann-Richtmyer concept of artificial viscosity that is used in calculating the propagation of shocks was formulated in one space-dimension. A generalization of the method for two and for three space-dimensions is presented here. The basic objectives were to find the one-dimensional equivalent of shock compression that avoided geometric convergence effects and to determine a characteristic grid length. A description is given of a linear viscosity for damping the spurious oscillations that arise when the quadratic von Neumann-Richtmyer artificial viscosity is used. The linear viscosity minimizes the smearing of the shock front. Unwanted distortions that can occur in multidimensional grids are discussed. Results in two and three dimensions are given for the Navier-Stokes-type viscosity developed to damp these distortions.

6450 High Energy Physics

REFER ALSO TO CITATION(S) 28319

28806 (CERN—81-07, pp 336-340) **Experiences using the 168/E microprocessor within the European Muon Collaboration (EMC).** Botterill, D.R. (Science Research Council, Chilton (UK). Rutherford and Appleton Labs.); Edwards, A.W. 17 Jul 1981. Dep. NTIS (US Sales Only).

From Conference on the application of microprocessors to high energy physics experiments; Geneva, Switzerland (4 May 1981).

The EMC has a large amount of data taken at the CERN SPS during 1980 still to be processed through its pattern recognition program. This program is large, about 700 K decimal bytes and needs on average 350 milliseconds/event of CPU time on an IBM 370/168. This program has recently been installed on a 168/E microprocessor at CERN. Experiences encountered in installing such a large program on a 168/E and in the subsequent data processing will be given.

6451 Particle Interactions And Properties - Experimental

REFER ALSO TO CITATION(S) 28247, 28248, 28316, 28342, 28348, 28861, 28862, 28863

28807 (BNL—51443(Vol.2), pp 576-583) **Possibility of observing Centauro events at ISABELLE.** Chau, L. (Brookhaven National Lab., Upton, NY); Goldhaber, M.; Wu, Y.S. 1981. NTIS, PC A18/MF A01.

From Physics opportunities at ISABELLE summer workshop; Upton, NY, USA (20 Jul 1981).

Cosmic ray experiments have provided some information about particle interactions around ISABELLE energies. Among others, the anomalous Centauro events have received in recent years more and more attention both from experimenters and theorists. Here we would like to give a short review about related data and recent simulation results and then examine how this surprising new phenomenon might manifest itself in ISABELLE experiments.

28808 (BNL—51443(Vol.2), pp 584-588) **Quark lepton coupling in lepton pair production.** Keung, W.Y.; Rizzo, T. (Brookhaven National Lab., Upton, NY). 1981. NTIS, PC A18/MF A01.

From Physics opportunities at ISABELLE summer workshop; Upton, NY, USA (20 Jul 1981).

We are to examine the consequences of the exotic interactions which change quark (q) into lepton (l) through a heavy gauge boson (X) in the form L/sub I/ = e anti l γ/sup μ/ (V - Aγ_5) q X/sub μ/. We study especially the process qq anti quark → lepton antilepton.

28809 (BNL—51443(Vol.2), pp 647-651) **Use of existing and proposed pp detectors to study heavy ion physics.** Thompson, J. (Univ. of Pittsburgh, PA). 1981. NTIS, PC A18/MF A01.

From Physics opportunities at ISABELLE summer workshop; Upton, NY, USA (20 Jul 1981).

In heavy ion collisions, if energy density or temperature reached in the collision is high enough, one may pass a phase transition from the state of physical vacuum of normal matter (separately identifiable nucleons to a state of the simple or perturbative vacuum and a high density quark and gluon soup in which the quarks and gluons are not confined to a physical nucleon bag but are free to move about the perturbative vacuum region. For temperatures (energy densities) above the phase transitions a number of interesting predictions can be made. This note focusses on a few specific predictions, and the possibility of testing these predictions with presently existing detectors or detectors likely to be in place at ISABELLE.

28810 (BNL—51443(Vol.2), pp 652-653) **Measuring two photon correlations.** Willis, W. 1981. NTIS, PC A18/MF A01.

From Physics opportunities at ISABELLE summer workshop; Upton, NY, USA (20 Jul 1981).

The point has been made repeatedly that the most effective probes of the interesting interior region in heavy ion collisions are weakly interacting particles, particularly leptons and photons. The use of virtual photons appearing as low mass lepton pairs, with m/ sub l anti l/ > m/sub π/, solves the problem of background from $\pi^0 \rightarrow \gamma\gamma$. We may expect that inclusive photon distributions can be obtained in this way, by extrapolation to zero pair mass, as well as the interesting information contained in the lepton pair mass distribution away from the photon pole.

28811 (BNL—51443(Vol.2), pp 724-736) **Some tests of the weak interactions at the Isabelle ep collider.** Rizzo, T. (Brookhaven National Lab., Upton, NY). 1981. NTIS, PC A18/MF A01.

From Physics opportunities at ISABELLE summer workshop; Upton, NY, USA (20 Jul 1981).

The purpose of this section is to examine two important areas of weak interaction physics that can be done with a 10(20) x 350 GeV ep collider at ISABELLE. We examine various weak asymmetries in the weak neutral current channel ep $\rightarrow$ eX as a test of the standard Weinberg-Salam model and compare these with the predictions of the left-right symmetric model (LRS) based on the SU(2)/sub L/ x SU(2)/sub R/ x U(1) gauge group. These two models are easily distinguished at $Q^2 \simeq 10^4$ GeV^2/c^2. We also examine the reaction e/sub R/p $\rightarrow$ NX where N is a heavy (10 to 100 GeV) Majorana neutrino and e/sub R/ a right-handed electron within the context of the standard model; roughly 10 events of this kind can be expected per day with an ISABELLE ep collider.

28812 (BONN-IR—80-12) **Inclusive production of neutral strange particles in a anti ν NeH_2 experiment in BEBC.** Glimpf, W. (Bonn Univ. (Germany, F.R.). Physikalisches Inst.). Jun 1980. 123p. (In German). Fachinformationszentrum, Energie, Physik, Mathematik, Karlsruhe, Germany, F.R.

Thesis.

In this work the inclusive production of neutral strange particles in a anti ν NeH_2 experiment is investigated. The experiment was performed with the CERN SPS-neutrino small band-beam and the big European bubble chamber BEBC. The mean neutron energy was about 104 GeV, about 80 GeV for the antineutrinos. The events were investigated with an identified muon in the final state, especially the subset with at least one neutral storage particle among the generated hadrons. The analysis was made in the quark-parton model.

28813 (BONN-IR—80-16) **Measurement of the decay of the J/psi resonance in decay channels with charged and neutral nucleons.** Wilcke, R. (Bonn Univ. (Germany, F.R.). Physikalisches Inst.). Aug 1980. 104p. (In German). Fachinformationszentrum Energie, Physik, Mathematik, Karlsruhe, Germany, F.R.

Thesis.

The non-magnetic BONANZA detector installed at the storage ring DORIS by Bonn/DESY/Mainz collaboration is particularly well suited for measuring baryonic channels because it is capable of detecting not only charged nucleons but also neutral ones. This property was used in the present work in order to carry out for the J/psi resonance simultaneous measurement of several decay channels, being distinguished from each other above all by the nucleons involved. The aim was a contribution to the determination of the interferences between electromagnetic and strong decay of the J/ psi resonance. The following branching ratios were measured: BR(J/psi $\rightarrow$ anti n pπ^-) = 0.17 +- 0.07%, BR(J/psi $\rightarrow$ anti n n$\pi^+\pi^-$) = 0.38 +- 0.36%, BR(J/psi $\rightarrow$ anti p nπ^+) = 0.16 +- 0.12%, BR(J/psi $\rightarrow$ anti p p$\pi^+\pi^-$) = 0.38 +- 0.16%, BR(J/psi $\rightarrow$ anti $\Sigma^-\Sigma^-$) = 0.24 +- 0.26%, BR(J/psi $\rightarrow$ anti Λ Λ) = 0.26 +- 0.16%. The relatively large error results from the short time of measurement and the small count rate associated with it.

28814 (CERN—81-07, pp 290-293) **Use of microprocessors in a neutrino experiment.** Connolly, P.L. (Brookhaven National Lab., Upton, NY (USA)); Cutts, D. (Brown Univ., Providence, RI (USA)). 17 Jul 1981. Dep. NTIS (US Sales Only).

From Conference on the application of microprocessors to high energy physics experiments; Geneva, Switzerland (4 May 1981).

28815 (LYCEN—8102, pp S12.1) **Δ^{++} resonance production on ^{6}Li at 1.04 GeV.** Bachelier, D. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire); Bedjidian, M. (Lyon-1 Univ., 69 - Villeurbanne (France). Inst. de Physique Nucleaire); Bilaniuk, O.M. (Swarthmore Coll., PA (USA). Dept. of Physics). [nd]. (In French). Dep. NTIS (US Sales Only).

From 6. biannual session of nuclear physics; Aussois, France (2 Feb 1981).

28816 (LYCEN—8102, pp S8.1-S8.5) **Energy dependence of the pp $\rightarrow$ πd differential cross section between 500 and 600 MeV.** Foroughi, F. (Neuchatel Univ. (Switzerland). Inst. de Physique). [nd]. (In French). Dep. NTIS (US Sales Only).

From 6. biannual session of nuclear physics; Aussois, France (2 Feb 1981).

Measured differential cross section for the reaction pp $\rightarrow$ πd has been measured and are compared with a theoretical prediction based on the coupled channel method. We used 3 potentials, namely: Ried, SSC and Paris. We discussed the possibility of the influence of a resonance in the $^1D_2$ channel.

6452 Particle Interactions And Properties - Theoretical

REFER ALSO TO CITATION(S) 28281, 28828, 28906, 28907

28817 (BNL—51443(Vol.2), pp 486-491) **Properties of W^{+-} and Z^0.** Parsa, Z.; Marciano, W.J. 1981. NTIS, PC A18/MF A01.

From Physics opportunities at ISABELLE summer workshop; Upton, NY, USA (20 Jul 1981).

Decay properties of the W^{+-} and Z^0 predicted by the standard SU(2)/sub L/ x U(1) Weinberg-Salam model are reviewed. Numerical estimates of the dominant decay rates and rare higher order induced decays are presented.

28818 (BNL—51443(Vol.2), pp 492-501) **Weak boson scenarios alternative to the standard model.** Schildknecht, D. (Univ. of Bielefeld, Germany). 1981. NTIS, PC A18/MF A01.

From Physics opportunities at ISABELLE summer workshop; Upton, NY, USA (20 Jul 1981).

To reveal the nature of the weak force is surely one of the most fascinating tasks of high energy physics of the '80s. What is empirically known up to now on weak interactions may be summarized by a local four fermion interaction with the normalizations of the charged and neutral current pieces being identical and a particular structure of the weak neutral current. While all our experimental evidence is so far consistent with the predictions of the standard model, the intermediate boson structure to be explored at high energies is by no means uniquely determined from what has been observed so far in the low energy regime. This is why weak boson hunting may still turn out to be an exciting adventure in the years to come.

28819 (BNL—51443(Vol.2), pp 503-535) **Search for new flavors at ISABELLE.** Ali, A. 1981. NTIS, PC A18/MF A01.

From Physics opportunities at ISABELLE summer workshop; Upton, NY, USA (20 Jul 1981).

The problem of production and detection of new heavy quark flavors at ISABELLE was studied. The problems specifically studied are presented in the following three sections: the production of heavy quarks and quarkonia is pp collisions; the production

of Higgs bosons (both charged and neutral) and hyperpions, through the decays of heavy quarkonia and quarks; the possibility of developing a vertex detector to measure the tracks of short lived particles produced in hadron-hadron collisions.

28820 (BNL—51443(Vol.2), pp 536-541) **Jets and heavy quarks in hadron-hadron collisions.** Babcock, J.B. (Carnegie-Mellon Univ., Pittsburgh, PA). 1981. NTIS, PC A18/MF A01.

From Physics opportunities at ISABELLE summer workshop; Upton, NY, USA (20 Jul 1981).

The top quark is the one fundamental fermion that is missing in the standard or minimal model of the electro-weak interactions. One should also bear in mind the possibility of discovering new generations of heavy quarks at high energies. It seems reasonable to try to anticipate some of the problems and physics opportunities connected with the discovery and study of heavy quarks that could be produced in the next generation of high energy machines. It is clearly important to examine the possible decays of new heavy quarks (or for that matter any new particle) in order to develop signatures. The decays of heavy fermions (presumably within heavy mesons) ought to yield resolvable jet-like structure which can be used as a signature as well as providing opportunities to study these decays.

28821 (BNL—51443(Vol.2), pp 566-570) **Strangeness as a charm probe in heavy jets.** Thompson, J. (Univ. of Pittsburgh, PA). 1981. NTIS, PC A18/MF A01.

From Physics opportunities at ISABELLE summer workshop; Upton, NY, USA (20 Jul 1981).

A question of interest for operation at ISABELLE is the development of a signature for the heavy quarks b and, optimistically, t. One approach, exemplified by the MIT (Ting) proposal, is to concentrate on the leptonic modes, particularly the muonic modes. Another approach is to try to disentangle the hadronic decay products in a jet originated by such quarks. One is encouraged in jet studies by experimental results from PETRA which show not only visible jet structure in some individual events but also success in analyzing entire event samples within a jet framework. In addition, the detailed phenomenological work of Babcoch and Cutkosky indicates that many properties of interest in a jet can be inferred from leading particle properties. This is encouraging, since the leading particles may be fairly easily assigned to the proper jet, whereas there may be considerable confusion for lower momentum particles. Using the ISAJET event generating program, I have investigated the role of strangeness identification as a handle on t, b recognition.

28822 (BNL—51443(Vol.2), pp 589-591) **Magnetic monopole searches at ISABELLE.** Giacomelli, G. (Univ. of Bologna, Italy); Kantardjian, G. 1981. NTIS, PC A18/MF A01.

From Physics opportunities at ISABELLE summer workshop; Upton, NY, USA (20 Jul 1981).

Unified theories of weak, electromagnetic and strong interactions have revived the interest in magnetic monopoles, predicting the existence of massive magnetic monopoles. In may theories the mass of the monopole is of the same order of magnitude (or larger) as the unifying mass (m/sub monopole/ $\simeq 10^{16}$ GeV); therefore these monopoles cannot be produced at any conceivable accelerator. In other theories the monopole mass, though large, could be within the experimental possibilities of a high energy, high luminosity accelerator such as ISABELLE. Searches for these relatively low mass magnetic monopoles were discussed in the 1975 ISABELLE workshop. Similar searches have been proposed for the CERN anti pp collider. The purpose of this short note is to recall and update the methods proposed in the 1975 ISABELLE workshop.

28823 (BNL—51443(Vol.2), pp 624-630) **Low mass dimuons as a probe of the phase of hadronic matter.** Melissinos, A. (Univ. of Rochester, NY). 1981. NTIS, PC A18/MF A01.

From Physics opportunities at ISABELLE summer workshop; Upton, NY, USA (20 Jul 1981).

It is widely believed that hadronic matter may exist in a quark phase and that this state may be realized during the collision of high energy elementary particles or nuclei. Calculations indicate that the required high density and temperature can be achieved using heavy ion beams with c.m. energies from a few to several GeV/nucleon; at some critical density and temperature a phase transition from nuclear to quark matter should occur implying a discontinuity in appropriate physical observables.

28824 (LYCEN—8102, pp C13.1.-C13.17) **Topological selection rules in hadron physics.** Nicolescu, B. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire). [nd]. (In French). Dep. NTIS (US Sales Only).

From 6. biannual session of nuclear physics; Aussois, France (2 Feb 1981).

In this talk we discuss the topological selection rules which govern the physics of multiquark states in the framework of the DTU theory. These new selection rules lead us to expect that narrow multiquark hadrons are rare, are strongly coupled only to some particular channels, and appear only in some restricted mass regions.

28825 (LYCEN—8102, pp C14.1-C14.11) **Topological bootstrap theory of strong interactions.** Poenaru, V. (Paris-11 Univ., 91 - Orsay (France)). [nd]. Dep. NTIS (US Sales Only).

From 6. biannual session of nuclear physics; Aussois, France (2 Feb 1981).

This paper presents some features of the new topological bootstrap theory proposed by G.F. Chew and the author. This theory associates to each component of a topological S-matrix expansion a pair of 2-dimensional objects ('surfaces') together with some extra structures, in particular embedded graphs. One of these objects, the 'classical surface' Σsub(C) is connected to the space-time description of collisions, the other one, the 'quantum surface' Σsub(C), with internal, discrete quantum numbers. Some consequences and symmetries are considered.

28826 (LYCEN—8102, pp C16.1-C16.23) **Large transverse momentum hadronic phenomena and jets.** Giffon, M. (Lyon-1 Univ., 69 - Villeurbanne (France). Inst. de Physique Nucleaire); Predazzi, E. (Istituto Nazionale di Fisica Nucleare, Turin (Italy)). [nd]. (In French). Dep. NTIS (US Sales Only).

From 6. biannual session of nuclear physics; Aussois, France (2 Feb 1981).

We discuss the evidence that hadronic reactions involving large transfers of transverse momentum are controled by the direct collision of constituents within the colliding hadrons, with subsequent fragmentation of these constituents in showers of hadrons. We review also the hadronic data showing that they are dominated by jet production, the trigger and away jets appearing as the dominant feature of the large transverse momentum data; we discuss their properties.

6453 Particle Invariance Principles And Symmetries

28827 (BNL—51443(Vol.2), pp 722-723) **Test of time reversal invariance in EP scattering.** Morse, W.M. (Brookhaven National Lab., Upton, NY); Schmidt, M.P. 1981. NTIS, PC A18/MF A01.

From Physics opportunities at ISABELLE summer workshop; Upton, NY, USA (20 Jul 1981).

CP invariance is violated in the K^0 - K^{-0} system. Assuming the validity of CPT, there is also a violation of time reversal invariance. This could be detected as a dipole electric moment of the neutron or a triple product correlation σ VECTOR/sub 1/ (p circumflex/sub 1/ x p circumflex /sub 2/). There are now gauge models which naturally explain the observed CP violation and predict measurable violation of time reversal invariance.

6454 Field Theory

REFER ALSO TO CITATION(S) 28280

28828 (BNL—51443(Vol.2), pp 443-446) **Average hadron multiplicity in hard jets.** Bassetto, A. (Universita di Trento, Italy). 1981. NTIS, PC A18/MF A01.

From Physics opportunities at ISABELLE summer workshop; Upton, NY, USA (20 Jul 1981).

Predictions are reviewed for the average multiplicity of hadrons in a hard jet, based on a perturbative QCD picture of jet evolution. One of the striking features that should distinguish hard scattering processes from low p/sub t/ physics is the average hadron multiplicity associated with a hard jet.

28829 (BNL—51443(Vol.2), pp 474-478) **Non-standard W^{+-} Z^0 physics.** Donoghue, J.F. (Univ. of Massachusetts, Amherst). 1981. NTIS, PC A18/MF A01.

From Physics opportunities at ISABELLE summer workshop; Upton, NY, USA (20 Jul 1981).

One of the beauties of the standard model is the precision with which the masses of the W^{+-} Z^0 can be predicted. Radioactive corrections connecting low energy parameters to the pole locations have been done by Marciano and Sirlin, and the masses are predicted to within 2%. The general expectation is that W's and Z^0 will be observed as predicted and this has lead to a sense of boredom with this aspect of physics. However, particle theory is presently exploring ideas which may lead to different predictions. It is the purpose of this section to play the devils advocate and describe ways which the standard model may go wrong.

28830 (BNL—51443(Vol.2), pp 551-553) **Signatures for a fourth generation of quarks.** Paschos, E.A. (Brookhaven National Lab., Upton, NY). 1981. NTIS, PC A18/MF A01.

From Physics opportunities at ISABELLE summer workshop; Upton, NY, USA (20 Jul 1981).

Presently there is no compelling reason for limiting the number of quark families to three. There is a bound on the number of neutrinos from cosmological considerations, which indirectly limits the number of quarks to be eight. This leaves open the possibility of detecting a new generation of quarks at ISABELLE. An inititial consideration concerns the effects of a new generation to the low energy phenomenology. In particular it is important to determine, which predictions of the Kobayashi-Maskawa model are modified when the number of quarks increases to eight. In a model with eight quarks the weak mixing matrix is replaced by a 4 x 4 matrix that contains six angles and three phases. A representation of this matrix is available with the attractive feature that several of the matrix elements have a functional form identical to that occurring in the KM matrix. A small angle approximation (neglecting terms cubic in the sines of the angles) is given.

28831 **(PB—81-858789) Bootstrap models in quantum field theory. January 1970-December 1980 (citations from the Searchable Physics Information Notices Data Base). Report for Jan 1970-Dec 1980.** (New England Research Application Center, Storrs, CT (USA)). Jan 1981. 70p. NTIS PC N01/MF N01.

This retrospective bibliography contains citations concerning bootstrap theory, models, and equations used in quantum field theory. Strong and weak particle interactions are considered for various particles and bootstrap configurations. Some attention is given to comparisons of the bootstrap approach with other approaches. (Contains 64 citations, fully indexed and including a table of contents.)

28832 **(PB—81-858797) Bag models in quantum chromodynamics and quantum electrodynamics. January 1970-December 1980 (citations from the Searchable Physics Information Notices Data Base). Report for Jan 1970-Dec 1980.** (New England Research Application Center, Storrs, CT (USA)). Jan 1981. 90p. NTIS PC N01/MF N01.

This retrospective bibliography contains citations concerning bag models and theories in quantum chromodynamics and quantum electrodynamics. Citations consider quark-quark interactions, quark-antiquark interactions, and other particle interactions encountered in quantum field theory. Considerations of gauge symmetry, gauge invariance, and symmetry breaking are also included. (Contains 80 citations, fully indexed and including a table of contents.)

28833 **Dual geometric field theory.** Rankin, J.E. (Los Alamos Scientific Lab., NM (USA)). *International Journal of Theoretical Physics;* **20**: No. 4, 231-256(Apr 1981).

A Weyl geometry with a gauge-invariant, Riemannian subgeometry is used to geometrize the combined Einstein-Maxwell theory. A generalized Hamilton-Jacobi equation from particle mechanics emerges as an immediate consistency requirement. The time-independent, Coulomb field case is found to include at least lowest-order quantum effects as in wave mechanics. Possible microscopic entropy is identified.

28834 (LYCEN—8102, pp C15.1-C15.23) **Highlights in particle physics on the unification of forces in particle physics.** Giffon, M. (Lyon-1 Univ., 69 - Villeurbanne (France). Inst. de Physique Nucleaire); Predazzi, E. (Istituto Nazionale di Fisica Nucleare, Turin (Italy)). [nd]. Dep. NTIS (US Sales Only).

From 6. biannual session of nuclear physics; Aussois, France (2 Feb 1981).

We examine the unification of weak and electromagnetic forces and we consider the possibility of unifying also the strong interactions, i.e. we discuss in an extremely sketchy way the case of QCD and beyond.

28835 (LYCEN—8102, pp S4.1-S4.9) **Quarkonium decays and QCD.** Bottino, A. (Istituto Nazionale di Fisica Nucleare, Turin (Italy)); Kim, C.W. (Johns Hopkins Univ., Baltimore, MD (USA). Dept. of Physics). [nd]. Dep. NTIS (US Sales Only).

From 6. biannual session of nuclear physics; Aussois, France (2 Feb 1981).

Test of Quantum Chromodynamics in quarkonium decays are discussed. Quantitative predictions of QCD for the hadronic widths of quarkonium decays are shown to fit well with the new experimental data on PSI and UPSILON. A new estimate for the PSI' decay width into ordinary hadrons is also given.

65 PHYSICS RESEARCH

6510 Nuclear Physics

REFER ALSO TO CITATION(S) 28278

28836 **(INDC(CCP)—161/L) Translation of selected papers presented by Heat and Mass-Exchange Institute of the Byelorussian Academy of Sciences in Minsk, at the fifth all-union conference on neutron physics 15-19 September, 1980 Kiev, USSR.** (International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee). Mar 1981. 36p. (CONF-8009198—). NTIS (US Sales Only), PC A03/MF A01.

From 5. national Soviet conference on neutron physics; Kiev, Ukrainian SSR (15 Sep 1980).

Translated from Russian.

Papers presented are entered in the data base separately. (WHK)

28837 (LYCEN—8102, pp C12.1-C12.16) **Investigation of exotic phenomena in heavy ion collisions at medium energies.** Mallet-Lemaire, M.C. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Service de Physique Nucleaire a Moyenne Energie). [nd]. (In French). Dep. NTIS (US Sales Only).

From 6. biannual session of nuclear physics; Aussois, France (2 Feb 1981).

Theoretical progress made toward signatures of compression effects, shock-wave, pion condensate or density isomer are reviewed and compared to recent experimental results.

6511 Experimental Techniques

REFER ALSO TO CITATION(S) 28318, 28358, 28389, 28399, 28400

28838 (CERN—81-09, pp 3-11) **Some recent developments in laser spectroscopy of unstable isotopes.** Otten, E.W. (Mainz Univ. (Germany, F.R.)). 20 Jul 1981. Dep. NTIS (US Sales Only).

From 4. international conference on nuclei far from stability; Helsignor, Denmark (7 Jun 1981).

On-line experiments on studying the hyperfine structure of unstable isotopes using laser radiation are reviewed.

28839 (CERN—81-09, pp 26-32) **Nuclear orientation of on-line separated isotopes.** Vanneste, L.; Vandeplassche, D.; van Walle, E.; Geenen, J.; Nuytten, C.; Marshak, H. (Leuven Univ. (Belgium). Inst. voor Kern- en Strahlingsfysika). 20 Jul 1981. Dep. NTIS (US Sales Only).

From 4. international conference on nuclei far from stability; Helsignor, Denmark (7 Jun 1981).

The purpose of nuclear orientation in the study of nuclei far from stability is explained. Various methods of nuclear orientation are compared. The Leuven setup and its initial performance are described.

28840 (INIS-mf—6819, pp 626) **Plunger chamber.** Gusinskii, G.M.; Mishin, A.S.; Lemberg, I.Kh.; Smirnov, A.S. 1981. (In Russian). Dep. NTIS (US Sales Only).

From 31. conference on nuclear spectroscopy and nuclear structure; Samarkand, USSR (14 Apr 1981).

28841 (INIS-mf—6819, pp 613) **Installation for studying short living radionuclides by laser spectroscopic methods.** Egodurov, S.D.; Izosimov, I.N.; Naumov, Yu.V.; Shishunov, N.A. 1981. (In Russian). Dep. NTIS (US Sales Only).

From 31. conference on nuclear spectroscopy and nuclear structure; Samarkand, USSR (14 Apr 1981).

28842 (INIS-mf—6819, pp 408) **Analysis of Doppler gamma line experimental shapes and calculation of F(tau) factors for the purpose of determining the lifetimes of nucleus excited states.** Pasternak, A.A. 1981. (In Russian). Dep. NTIS (US Sales Only).

From 31. conference on nuclear spectroscopy and nuclear structure; Samarkand, USSR (14 Apr 1981).

6512 Nuclear Properties And Reactions, A=1-5

REFER ALSO TO CITATION(S) 28846

28843 (LYCEN—8102, pp S18.1-S18.9) **Low-momentum behavior of the deuteron wavefunctions.** Zingl, H.F.K.; Schwarz, K. (Graz Univ. (Austria). Inst. fuer Theoretische Physik); Crepinsek, L. [nd]. Dep. NTIS (US Sales Only).

From 6. biannual session of nuclear physics; Aussois, France (2 Feb 1981).

We discuss the deuteron wave functions at low momenta and find a similar behavior of the wavefunctions derived from the Reid-potential and from the meson theoretical potentials of the Nijmegen and Paris group. This is compared with realists wave functions derived from separable potentials.

6513 Nuclear Properties And Reactions, A=6-19

REFER ALSO TO CITATION(S) 28815, 28850

28844 (CERN—81-09, pp 297-301) **β-delayed charged particles from ^{9}Li and ^{11}Li.** Langevin, M.; Detraz, C.; Guillemaud, D.; Naulin, F. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire); Epherre, M.; Klapisch, R.; Mark, S.K.T.; Saint-Simon, M. de; Thibault, C.; Touchard, F. (Daikin Kogyo Co. Ltd., Osaka (Japan)). 20 Jul 1981. Dep. NTIS (US Sales Only).

From 4. international conference on nuclei far from stability; Helsignor, Denmark (7 Jun 1981).

β-delayed emission of α particles from ^{9}Li and both α and ^{6}He particles from ^{11}Li is observed. New β branches are reported which populate high-energy levels in the daughter nuclei. The branching ratios are measured and the β delayed neutron emission probabilities Pn for ^{9}Li and P$_{2}$sub(n) for ^{11}Li are deduced.

28845 (CERN—81-09, pp 312-316) **Particle unstable excited states in ^{9}Be: influence of beta recoil and width on delayed particle spectra.** Nyman, G.; Jonson, B. (European Organization for Nuclear Research, Geneva (Switzerland). ISOLDE Collaboration); Azuma, R.E. (Toronto Univ., Ontario (Canada). Dept. of Physics); Kratz, K.L.; Ziegert, W. (Mainz Univ. (Germany, F.R.). Inst. fuer Kernchemie); Larsson, P.O.; Mattsson, S. (Chalmers Tekniska Hoegskola, Goeteborg (Sweden). Dept. of Physics). 20 Jul 1981. Dep. NTIS (US Sales Only).

From 4. international conference on nuclei far from stability; Helsignor, Denmark (7 Jun 1981).

The light nucleus ^{9}Be has been studied through the emission of beta-delayed neutrons and alpha particles from ^{9}Li. The activity was produced at the ISOLDE facility in fragmentation reactions induced either by 600 MeV proton or 910 MeV ^{3}He beams from the CERN Synchro-cyclotron. After mass separation, neutron spectra were recorded using ^{3}He-filled proportional counters, while surface barriere detectors were used for the spectroscopy of alpha particles. Effects on the spectrum shape induced by recoil and polarization phenomena as well as large widths of the intermediate states are discussed.

28846 (INIS-mf—6819, pp 453) **Accounting, for the Coulomb effects in the (p,p') and (p,n) reactions representing by triangular diagram.** Baryshnikov, A.G.; Dolinskii, E.I.; Krekoten, S.P. 1981. (In Russian). NTIS (US Sales Only), PC A99/MF A01.

From 31. conference on nuclear spectroscopy and nuclear structure; Samarkand, USSR (14 Apr 1981).

28847 (LYCEN—8102, pp S13.1) **Semiclassical and DWBA analyses of excitation functions of ^{12}C(^{6}Li,t)^{15}O.** Kraus, L.; Linck, I. (Strasbourg-1 Univ., 67 (France). Centre de Recherches Nucleaires). [nd]. (In French). Dep. NTIS (US Sales Only).

From 6. biannual session of nuclear physics; Aussois, France (2 Feb 1981).

28848 (LYCEN—8102, pp S5.1-S5.6) **Study of the fusion reaction ^{13}C+^{13}C.** Charvet, J.L.; Dayras, R.; Fieni, J.M.; Joly, S.; Uzureau, J.L. (CEA Centre d'Etudes de Bruyeres-le-Chatel, 92 - Montrouge (France)). [nd]. (In French). Dep. NTIS (US Sales Only).

From 6. biannual session of nuclear physics; Aussois, France (2 Feb 1981).

Total cross section for the ^{13}C + ^{13}C reaction has been determined over the range Esub(c.m.) = 4.00 - 15.5 MeV. The γ-ray yields are used to determine the cross sections for the formation of residual nuclei. Excitation functions reveal no evidence for intermediate structures or narrow resonances in this reaction. The results are in good agreement with predictions from a statistical model, calculation as coded in the computer program CASCADE.

6514 Nuclear Properties And Reactions, A=20-38

REFER ALSO TO CITATION(S) 28868

28849 (CERN—81-09, pp 306-311) **Kinematic shifts of β-delayed particles as a probe of β-ν angular correlations.** Clifford, E.T.H.; Azuma, R.E.; Jackson, K.P.; Koslowsky, V.T. (Toronto Univ., Ontario (Canada). Dept. of Physics); Hardy, J.C.; Schmeing, H.; Faestermann, T.; Schrewe, U.J. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.); Evans, H.C. (Queen's Univ., Kingston, Ontario (Canada). Dept. of Physics); Hagberg, E. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs. 20 Jul 1981. Dep. NTIS (US Sales Only).

From 4. international conference on nuclei far from stability; Helsignor, Denmark (7 Jun 1981).

Beta-delayed particles undergo a kinematic shift in energy due to recoil motion of the daughter nucleus following beta decay. A careful measurement of this energy shift can be used to establish the ratio of vector to axial vector components in beta transitions. Alpha-beta coincidence data for the beta-delayed alpha decay of ^{20}Na have been obtained. Component ratios for 6 transitions including the super-allowed branch were found. Limits on charge dependent mixing with the analogue state were deduced for 5 states in ^{20}Nesup(*). For the superallowed branch the axial vector component was found; the polar vector component was deduced and establishes a value for the vector weak coupling constant of Gsub(V) = (1.355 +- 0.036) x 10^{-49} erg cm^3.

28850 (CERN—81-09, pp 265-275) **Beta-delayed two-neutron and three-neutron emission.** Jonson, B.; Gustafsson, H.A.; Hoff, P.; Nyman, G.; Ravn, H.L.; Schardt, D. (European Organization for Nuclear Research, Geneva (Switzerland). ISOLDE Collaboration); Hansen, P.G. (Aarhus Univ. (Denmark). Inst. of Physics); Larsson, P.O.; Mattsson, S. (Chalmers Tekniska Hoegskola, Goeteborg (Sweden). Institutionen foer Fysik). 20 Jul 1981. Dep. NTIS (US Sales Only).

From 4. international conference on nuclei far from stability; Helsignor, Denmark (7 Jun 1981).

We review experiments on ^{11}Li that have led to the observation of two new radioactive decay modes: beta-delayed two- and three-neutron emission. The 2nd decay mode was also observed in ^{30,31,33}Na and very recent results, reported for the first time here, show that it is detectable also in ^{100}Rb with P_3sub(n)/Psub(n) = 0.027 +- 0.007.

28851 (CERN—81-09, pp 296) **Search for β-delayed three-neutron emission from ^{31}Na.** Detraz, C.; Guillemaud, D.; Langevin, M.; Naulin, F. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire); Epherre, M.; Klapisch, R.; Saint-Simon, M. de; Thibault, C.; Touchard, F. (Centre National de la Recherche Scientifique, 91 - Orsay (France). Lab. Rene Bernas). 20 Jul 1981. Dep. NTIS (US Sales Only).

From 4. international conference on nuclei far from stability; Helsignor, Denmark (7 Jun 1981).

An upper limit P_3sub(n) < 5 x 10^{-4} is found for the branching ratio of the β-delayed three-neutron emission from ^{31}Na.

28852 (CERN—81-09, pp 302-305) **Evidence for β-delayed neutron emission from ^{31}Mg and ^{32}Mg.** Zaidins, C.S.; Detraz, C.; Langevin, M.; Guillemaud, D.; Naulin, F. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire); Epherre, M.; Audi, G.; Klapisch, R.; Saint-Simon, M. de; Thibault, C. (Paris-11 Univ., 91 - Orsay (France). Centre de Spectrometrie Nucleaire et de Spectrometrie de Masse). 20 Jul 1981. Dep. NTIS (US Sales Only).

From 4. international conference on nuclei far from stability; Helsignor, Denmark (7 Jun 1981).

We have used β-neutron coincidence detection to investigate the time spectrum of β-delayed neutron emission from $^{30-34}$Na and their descendants. We have been able to assign an upper limit to 0.4% to the probability of β-delayed neutron emission, Psub(n), from the ^{30}Na daughter isotope ^{30}Mg. In fitting the time spectra of β-delayed neutrons from ^{31}Na and ^{32}Na, we find a definitive component from subsequent daughter decay as well. This provides evidence for β-delayed neutron emission from ^{31}Mg and ^{32}Mg with Psub(n) values of the order of 2% for each. We are currently designing a detection system with greatly enhanced efficiency to study this phenomena in more detail.

28853 (CERN—81-09, pp 327-333) **Energy spectra of beta-delayed neutrons from $^{27-31}$Na decay.** Ziegert, W.; Kratz, K.L.; Ohm, H.; Schroeder, A. (Mainz Univ. (Germany, F.R.). Inst. fuer Kernchemie); Carraz, L.C.; Jonson, B.; Nyman, G.; Ravn, H.L. (European Organization for Nuclear Research, Geneva (Switzerland). ISOLDE Collaboration); Hansen, P.G. (Aarhus Univ. (Denmark). Inst. of Physics). 20 Jul 1981. Dep. NTIS (US Sales Only).

From 4. international conference on nuclei far from stability; Helsignor, Denmark (7 Jun 1981).

High resolution energy spectra of β-delayed neutrons from the decay of $^{27-31}$Na have been measured. From the experimental β-decay properties of these isotopes, first information on their decay schemes and β-strength functions is obtained.

28854 (LYCEN—8102, pp S3.1-S3.11) **Study of ^{28}Si, ^{34}S and ^{40}Ca by ^{32}S inelastic scattering near the Coulomb barrier.** Bilwes, B.; Bilwes, R. (Strasbourg-1 Univ., 67 (France). Centre de Recherches Nucleaires); Diaz, J.; Ferrero, J.L.; Moreno, A. (Valencia Univ. (Spain). Dept. de Fisica Fundamental). [nd]. (In French). Dep. NTIS (US Sales Only).

From 6. biannual session of nuclear physics; Aussois, France (2 Feb 1981).

Angular distributions of elastic and inelastic scattering to the first 2^+ states of ^{28}Si, ^{32}S and ^{34}S have been measured at 77 and 90 Mev-Lab. The order of magnitude of nuclear deformations was given by an analysis with the Closed Formalism of Frahn. Clear evidence for oblate shape of the 2^+ state of ^{28}Si, prolate shape of the 2^+ state of ^{32}S was obtained with coupled channel calculations. Rotational model for ^{32}S, vibrational for ^{34}S give a good account of the data with some of given optical potentials. The system ^{32}S + ^{40}Ca was studied at 100 MeV-Lab. The analysis, made with the same hypothesis, shows a great sensitivity to the models. Excitation of 2^+ level of ^{40}Ca is suggested.

6515 Nuclear Properties And Reactions, A=39-58

REFER ALSO TO CITATION(S) 28854, 28880, 28893

28855 (CERN—81-09, pp 292-295) **Excitation of the giant quadrupole resonance in ^{58}Ni with ^{20}Ne.** Bohlen, H.G.; Clover, M.; Ingold, G.; Lettau, H.; Ossenbrink, H.; Oertzen, W. von (Hahn-Meitner-Institut fuer Kernforschung Berlin G.m.b.H. (Germany, F.R.)). 20 Jul 1981. Dep. NTIS (US Sales Only).

From 4. international conference on nuclei far from stability; Helsignor, Denmark (7 Jun 1981).

The heavy-ion induced excitation of the quadrupole resonance in ^{58}Ni has been studied with ^{20}Ne beams of 14.5 and 19.6 MeV/N incident energy. The broad resonance structure is clearly observed; the strength exhausts 44% and 60% of the energy weighted sum rule (EWSR) at the two incident energies, respectively. The background is partly explained by a three-body reaction mechanism, which is based on the one-nucleon pick-up reaction into unbound states followed by one-nucleon emission. The remaining part is interpreted as inelastic excitation of other multipoles.

28856 (LYCEN—8102, pp S11.1-S11.8) **Microscopic description of the transition densities for ^{58}Ni and ^{152}Sm.** Girod, M. (CEA Centre d'Etudes de Bruyeres-le-Chatel, 92 - Montrouge (France)); Grammaticos, B. (Strasbourg-1 Univ., 67 (France). Centre de Recherches Nucleaires). [nd]. (In French). Dep. NTIS (US Sales Only).

From 6. biannual session of nuclear physics; Aussois, France (2 Feb 1981).

Transition densities of the Nickel and Samarium isotopes are computed in the HFB approximation. Using various models that we

discuss, we have introduced dynamical effects in these calculations. Our results are compared to the available experimental data.

28857 (LYCEN—8102, pp S16.1-S16.4) **Study of angular momentum transfer from sequential fission in deeply inelastic collisions ^{40}Ar-^{209}Bi at 255 MeV.** Le Brun, C.; Lecolley, J.F.; Lefebvres, F.; L'Haridon, M.; Osmont, A.; Patry, J.P.; Steckmeyer, J.C. (Caen Univ., 14 (France). Lab. de Physique Corpusculaire); Chechik, R. (Weizmann Inst. of Science, Rehovoth (Israel). Dept. of Nuclear Physics); Guilbault, F. (Nantes Univ., 44 (France). Lab. de Physique Corpusculaire). [nd]. (In French). Dep. NTIS (US Sales Only).

From 6. biannual session of nuclear physics; Aussois, France (2 Feb 1981).

We have measured the angular distribution of the target-like reaction product fission fragments emitted in coincidence with the light projectile like reaction product. For the first time, a sequential fission experiment in deeply inelastic collisions has observed an increase of the width of the out of plane angular distributions with the in-plane angle phi. The in-plane distribution exhibits an anisotropy centered in the recoil direction of the heavy fissionning nucleus, and shows up a dealignment mechanism of the transferred angular comparatively to the normal to the reaction plane. The dealigned spin components have a gaussian distribution with a r.m.s width of about 10h and are lying preferentially in a plane perpendicular to the recoil direction. The mean value of the aligned component is of about 45h in agreement with the sticking limit with deformed nuclei. The dependence of the target-like reaction product fission probabilities on the total kinetic energy loss and Z of the projectile-like reaction product have been measured.

6516 Nuclear Properties And Reactions, A=59-89

REFER ALSO TO CITATION(S) 28357, 28868, 28872

28858 (INIS-SU—37, pp 109-112) **Definition of the absolute quantum yield of 196.1 keV gamma radiation for krypton-88 using the amplitude-time analysis of gamma spectrum of a nonseparative fission product mixture.** Gudkov, A.N.; Zhivun, V.M.; Kovalenko, V.V.; Koldobskij, A.B.; Kolobashkin, V.M.; Koptev, M.A.; Kotlyarov, A.A. 1979. (In Russian). Dep. NTIS (US Sales Only).

In Experimental methods of nuclear physics. No. 5.

The absolute quantum yield of the ^{88}Kr 196 keV gamma-line was specified by the slow amplitude-time analysis method. The experiment was carried out on a MIPhI IRT-200 research reactor. A sample of fissionable material (uranium-235 with 90% enrichment) was irradiated during 30 min in the vertical reactor channel. The neutron flux density in the place of irradiation was about 10^{11} neutr/cm^{2}xs. After exposure the sample was measured on a Ge(Li)-coaxial detector with the 2.3 keV resolution in the ^{57}Co 122 keV gamma-line. The distance from the sample to the surface of the detector was 11 cm. For data gathering on the gamma spectrum of the sample a multi-channel amplitude analyzer is used. Gamma spectrum processing and analysis of the results obtained were performed using computer programs. The value obtained of the absolute quantum yield of the 196 keV gamma line of krypton-88 was 24.5+-0.9%, that provides a satisfactory data interpretation obtained in the gamma spectrometric investigations of radioactive gas leakage from fuel compositions.

28859 (LYCEN—8102, pp C18.1-C18.21) **Reaction mechanisms in the medium-weight heavy ion scattering at energies of a few MeV per nucleon.** Richert, J. (Strasbourg-1 Univ., 67 (France). Centre de Recherches Nucleaires). [nd]. (In French). Dep. NTIS (US Sales Only).

From 6. biannual session of nuclear physics; Aussois, France (2 Feb 1981).

The reaction cross sections observed in the collision of ^{32}S on the medium-weight nuclei ^{59}Co, ^{65}Cu, ^{74}Ge, ^{79}Br, ^{85}Rb and ^{89}Y at a few MeV per nucleon bombarding energies are studied. The mass transfer from one fragment to the other which behaves differently for different targets is analysed in the framework of a classical transport model. The relevance of structure effects investigated. The nature of the reaction mechanism is discussed.

6517 Nuclear Properties And Reactions, A=90-149

REFER ALSO TO CITATION(S) 28850, 28856, 28887, 28888, 28893, 28902

28860 (BNL—51443(Vol.2), pp 619-623) **Impact parameter measurements in nucleus-nucleus collisions at the ISR.** Frankel, S. (Univ. of Pennsylvania, PA). 1981. NTIS, PC A18/MF A01.

From Physics opportunities at ISABELLE summer workshop; Upton, NY, USA (20 Jul 1981).

There are two complementary ways to measure impact parameters in nucleus-nucleus collisions. A collision between two nuclei with atomic number A is illustrated, the overlap of N nucleons in each nucleus determined by the geometric impact parameter. The non-interacting A-N nucleons, the spectators, are roughly confined to an inner cone surrounding the incident projectile direction. They consist of fragments from A-N to 1. The transverse momentum distributions has been measured at energies of 1 to 2 GeV/nucleon and recently at the ISR (by group 418) at 500GeV/nucleon. The distribution at both energies fall exponentially with the square of the transverse momentum. The falloff is twice as slow at 1000 as compared with 2 GeV/c. This is the result of the very large multiplicity at ISR energies, the pions blowing out the fragments. The important feature to understand is that these fragments are essentially independent of the mechanisms that take place in the interaction between the 2N interacting nucleons. Therefore the detection of the number of nucleons in this region is a mechanism independent way to measure the impact parameter.

28861 (BNL—51443(Vol.2), pp 636-640) **Estimate of energy densities in heavy ion collisions.** Mueller, A.H. (Brookhaven National Lab., Upton, NY). 1981. NTIS, PC A18/MF A01.

From Physics opportunities at ISABELLE summer workshop; Upton, NY, USA (20 Jul 1981).

One can give rather simple arguments as to the A-dependence of energy densities achieved in high energy heavy ion collisions. Before giving these arguments it is convenient to discuss the related problem of the number of particles produced per unit rapidity interval, dN/dy, in a central heavy ion collision. We take the two colliding ions to be identical with atomic number A.

28862 (BNL—51443(Vol.2), pp 641-644) **Central collision trigger for heavy-ions: the Bevalac experience.** Schroeder, L.S. (Lawrence Berkeley Lab., CA). 1981. NTIS, PC A18/MF A01.

From Physics opportunities at ISABELLE summer workshop; Upton, NY, USA (20 Jul 1981).

In order to guarantee that the highest possible temperature is achieved in a A-A collision, one needs to have the largest number of nucleons from the colliding beams participating. This clearly implies the need of establishing a criteria for central A-A collisions. This question was one of the first addressed at the Bevalac (~ 0.4 to 0.5 GeV/nucleon in the c.m. system), where the interest was in looking for shock waves, pion condensates and other possible collective nuclear phenomena. In light of this, a technique is summarized which has been used at the Bevalac to restrict events to those involving nearly central collisions.

28863 (BNL—51443(Vol.2), pp 645-646) **Some numbers for heavy ion collisions.** Schroeder, L.S. (Lawrence Berkeley Lab., CA). 1981. NTIS, PC A18/MF A01.

From Physics opportunities at ISABELLE summer workshop; Upton, NY, USA (20 Jul 1981).

A guess at A-A multiplicities and π, K^+, p temperatures (Bevalac energies) are briefly stated.

28864 (CERN—81-09, pp 62-64) **Calculation of S_2/sub n/ and delta$<r^2>$ on long series of Kr, Rb, Sr and Xe, Cs, Ba isotopes.** Epherre, M.; Audi, G. (Centre National de la Recherche Scientifique, 91 - Orsay (France). Lab. Rene Bernas); Campi, X. (Centre National de la Recherche Scientifique, 91 - Orsay (France). Div. de Physique Theorique). 20 Jul 1981. Dep. NTIS (US Sales Only).

From 4. international conference on nuclei far from stability; Helsignor, Denmark (7 Jun 1981).

The Density Dependent Hartree-Fock method has been used to study the variation of the two neutron separation energies (S$_n$/sub n/) and of the mean square charge radii (delta<r^2>) on long series of isotopes. Correlations between anomalous S$_n$/sub n/, delta<r^2> and deformations have been analyzed.

28865 (CERN—81-09, pp 107-114) **Spectroscopy and mass measurements of neutron rich isotopes by the (t,α) reaction.** Flynn, E.R.; Brown, R.E.; Sunier, J.W.; Burke, D.G.; Ajzenberg-Selove, F.; Cizewski, J.A. (Los Alamos Scientific Lab., NM (USA)). 20 Jul 1981. Dep. NTIS (US Sales Only).

From 4. international conference on nuclei far from stability; Helsignor, Denmark (7 Jun 1981).

The neutron excess of the triton makes it possible to use this projectile in transfer reactions to reach nuclei of greater neutron excess than the target nucleus. Principal examples of such reactions are the (t,α), (t,p) and (t,^{3}He) reactions, all of which have been used to study neutron rich nuclei. The present report discusses several of these examples and reports on more definitive mass measurements and spectroscopy of the low lying levels of some of these nuclei. In particular, results of using a polarized triton beam are discussed as this study leads to many new spin assignments.

28866 (CERN—81-09, pp 215-216) **Delayed-proton and -alpha emission.** Feix, W. (Technische Hochschule Darmstadt (Germany, F.R.). Inst. fuer Kernphysik). 20 Jul 1981. Dep. NTIS (US Sales Only).

From 4. international conference on nuclei far from stability; Helsignor, Denmark (7 Jun 1981).

Delayed-proton and delayed-alpha spectra and their branching ratios are theoretically studied for neutron deficient heavy nuclei. The results exhibit a strong model dependence of the analysis. This implies a difficulty of deducing details of the β-strength function of the precursors from such an analysis.

28867 (CERN—81-09, pp 317-326) **Beta minus strength function of nuclei far from stability in the A = 90 mass region.** Kratz, K.L.; Ohm, H.; Schroeder, A.; Gabelmann, H.; Ziegert, W. (Mainz Univ. (Germany, F.R.). Inst. fuer Kernphysik); Klapdor, H.V.; Metzinger, J.; Oda, T. (Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.)); Pfeiffer, B.; Jung, G. (Institut Max von Laue - Paul Langevin, 38 - Grenoble (France). 20 Jul 1981. Dep. NTIS (US Sales Only).

From 4. international conference on nuclei far from stability; Helsignor, Denmark (7 Jun 1981).

The existing experimental β-strength functions, S/sub β/(E), in the A = 90 mass region are reviewed and compared to nuclear model predictions. Systematic trends in S/sub β/(E) as a function of nuclear type and excitation energy, as well as the influence of shell effects and deformation are discussed.

28868 (CERN—81-09, pp 47-55) **Masses and radii of alkali nuclei.** Thibault, C. (Centre National de la Recherche Scientifique, 91 - Orsay (France). Lab. Rene Bernas). 20 Jul 1981. Dep. NTIS (US Sales Only).

From 4. international conference on nuclei far from stability; Helsignor, Denmark (7 Jun 1981).

The various nuclear information concerning alkali isotopes which have been obtained either by on-line mass spectrometry or by on-line laser spectroscopy are reviewed. Mass spectrometry provided mass-determinations while laser spectroscopy provided values of I, μ, Qsub(s) and delta<r^2>. The masses and the variations of the mean square charge radii are presented and briefly discussed.

28869 (CERN—81-09, pp 116-123) **Critical survey of beta-decay energies and nuclear masses for the neutron-rich Rb and Cs isotopes.** Keyser, U.; Muennich, F.; Pahlmann, B. (Technische Univ. Braunschweig (Germany, F.R.)); Pfeiffer, B. (Institut Max von Laue - Paul Langevin, 38 - Grenoble (France)). 20 Jul 1981. Dep. NTIS (US Sales Only).

From 4. international conference on nuclei far from stability; Helsignor, Denmark (7 Jun 1981).

Recent experimental results of beta-decay energies for very neutron-rich Rb and Cs isotopes with mass number 94 <= A <= 98 and 142 <= A <= 146, respectively, are presented. From these Qsub(β)-values, mass excesses are derived for the nuclei studied, which are compared with those obtained in direct mass determinations. The advantages and difficulties inherent in both experimental methods are shortly discussed. Finally, the information which can be drawn from a systematic study of beta-decay energies to gain new insight into nuclear structure effects will be mentioned.

28870 (CERN—81-09, pp 124-128) **Nuclear Qsub(β)-values for fission products. A comparison with mass formula predictions.** Aleklett, K.; Hoff, P.; Lund, E.; Rudstam, G. (Naturvetenskapliga Foskningslab., Nykoeping (Sweden)). 20 Jul 1981. Dep. NTIS (US Sales Only).

From 4. international conference on nuclei far from stability; Helsignor, Denmark (7 Jun 1981).

Experimental Qsub(β)-values for fission products are presented. The sources were produced as mass separated fission products at the OSIRIS on-line isotope separator. Recently determined Qsub(β)-values for ^{79,81}Ga, ^{79,81,83}Ge, ^{89,90}Br, ^{119,121}Ag, ^{119,121}Cd and ^{139}I are, together with 40 earlier measured values, compared with mass formula predictions.

28871 (CERN—81-09, pp 148-155) **Atomic masses of rare-earth isotopes.** Schmidt-Ott, W.D.; Kantus, R.; Runte, E. (Goettingen Univ. (Germany, F.R.). 2. Physikalisches Inst.); Michaelsen, R. (Hahn-Meitner-Institut fuer Kernforschung Berlin G.m.b.H. (Germany, F.R.)). 20 Jul 1981. Dep. NTIS (US Sales Only).

From 4. international conference on nuclei far from stability; Helsignor, Denmark (7 Jun 1981).

A survey is given of decay energies of rare-earth isotopes measured in electron-capture decay by relative Psub(K) ratios, ECsub(K)/β^+, and EC/β^+ ratios. Atomic masses of A = 147 isotopes and of ^{146}Gd and ^{148}Dy were derived. The masses of these isotopes and of α-decaying precessors are compared with predictions of current mass formulae. The subshell closure at Z = 64 is shown for N = 82, and 84 isotones.

28872 (CERN—81-09, pp 156-162) **Qsub(β) measurements and mass excess values for neutron deficient isotopes near N approx. equal to Z approx. equal to 40.** Della-Negra, S.; Deprun, C.; Husson, J.P.; Jacquet, D.; le Beyec, Y. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire). 20 Jul 1981. Dep. NTIS (US Sales Only).

From 4. international conference on nuclei far from stability; Helsignor, Denmark (7 Jun 1981).

The decay characteristics of neutron deficient isotopes of Sr, Y, Zr have been studied. Mass excess values have been deduced from Qsub(β) measurements and the results compared with the mass tables. Large deviations from theoretical predictions are observed.

28873 (CERN—81-09, pp 163-167) **Nuclide masses close to the proton drip line in the tin region.** Plochocki, A.; Zylicz, J. (Warsaw Univ. (Poland). Inst. Fizyki Doswiadczalnej); Kirchner, R.; Klepper, O.; Roeckl, E.; Tidemand-Petersson, P. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.)); Grant, I.S.; Misalides, P. (Manchester Univ. (UK). Schuster Lab.); Schmidt-Ott, W.D. (Goettingen Univ. (Germany, F.R.). 2. Physikalisches Inst.). 20 Jul 1981. Dep. NTIS (US Sales Only).

From 4. international conference on nuclei far from stability; Helsignor, Denmark (7 Jun 1981).

Recently measured Q-values for alpha decays, β^+/EC decays and β-delayed proton decays in the tin region are used to link from known mass-excess values to new ones close to the proton drip line. The strength to the Z = 50 proton shell is derived from experimental data in a model-independent way. Proton binding energies are deduced, showing that e.g. ^{114}Cs is barely bound against proton emission with a proton binding energy of 290 +- 200 keV. The results are discussed in terms of semi-empirical mass formulae.

28874 (CERN—81-09, pp 168-173) **Alpha-decay studies and search for ground-state proton radioactivity around tin and lead.** Schardt, D.; Nyman, G. (European Organization for Nuclear Research, Geneva (Switzerland). ISOLDE Collaboration); Batsch, T.; Kirchner, R.; Klepper, O.; Kurcewicz, W.; Roeckl, E. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.)); Tidemand-Petersson, P.; Schrewe, U.J. (Goettingen Univ. (Germany, F.R.). 2. Physikalisches Inst.). 20 Jul 1981. Dep. NTIS (US Sales Only).

From 4. international conference on nuclei far from stability; Helsignor, Denmark (7 Jun 1981).

Using on-line mass separation of evaporation residues from heavy-ion induced fusion reactions, the α-decay of very neutron deficient nuclei with 52 <= Z <= 55 - including the recently identified new isotopes ^{110}Xe and ^{106}Te - and 78 <= Z <= 83 was investigated. The results and the systematics of α-decay energies and reduced widths are discussed.

28875 (CERN—81-09, pp 205-214) **Beta-delayed particle emission from neutron-deficient isotopes in the Z approx. equal to 50 region.** Tidemand-Petersson, P.; Kirchner, R.; Klepper, O.; Roeckl, E. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.)); Plochocki, A.; Zylicz, J. (Warsaw Univ. (Poland). Inst. Fizyki Doswiadczalnej); Schardt, D. (European Organization for Nuclear Research, Geneva (Switzerland). EP-Div.). 20 Jul 1981. Dep. NTIS (US Sales Only).

From 4. international conference on nuclei far from stability; Helsignor, Denmark (7 Jun 1981).

Experimental studies of beta-delayed proton and alpha-particle emission from precursors in the region close to the double shell closure at N = Z = 50 are described. The results range from identification of new precursors like ^{90}Ag and ^{103,108}Sn, to determination of branching ratios, feeding of excited levels after particle emission and the energy available for proton emission. Comparison of the results with statistical-model calculations points to a resonance in the beta-strength function in the decay of ^{110,112}I, ^{113}Xe, ^{114,116}Cs, and ^{117}Ba.

28876 (CERN—81-09, pp 217-228) **Decay experiments to test β- and γ-strength functions.** Hardy, J.C. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). 20 Jul 1981. Dep. NTIS (US Sales Only).

From 4. international conference on nuclei far from stability; Helsignor, Denmark (7 Jun 1981).

The decays of six delayed-proton precursors have now been studied with the particle-X-ray coincidence technique, yielding a more or less detailed view of level widths in the proton emitting nuclei. The results lead to a reevaluation of our techniques for calculating level densities and average gamma-decay widths in exotic nuclei. With these aspects of β-delayed proton decay specified, the proton energy spectra of a number of precursors (65 <= A <= 121) are examined for evidence of structure in the β-strength functions. Overall, the 'gross theory' β-strength functions are remarkably reliable, although some systematic deviations are observed in the xenon and tellurium isotopes.

28877 (CERN—81-09, pp 247-252) **New beta delayed proton emitter ^{93}sup(m)Ru.** Aeystoe, J.; Honkanen, J. (Jyvaeskylae Univ. (Finland). Dept. of Physics); Eskola, K.; Vierinen, K. (Helsinki Univ. (Finland). Dept. of Physics); Messelt, S. (Oslo Univ. (Norway). Fysisk Inst.). 20 Jul 1981. Dep. NTIS (US Sales Only).

From 4. international conference on nuclei far from stability; Helsignor, Denmark (7 Jun 1981).

The 10.8 s, $1/2^-$ isomer of ^{93}Ru is shown to be a β-delayed proton precursor. The absolute branching ratio for this decay mode is determined to be (2.7 +- 0.5) x 10^{-4}. The measured total decay energy of ^{93}sup(m)Ru is 7.06 +- 0.20 MeV. The delayed proton spectrum has prominent peaks at 2.481, 2.534 and 2.557 MeV indicating structural effects in the β-strength function. The level structure of ^{93}Tc was also studied by the ^{92}Mo(p,γ)^{93}Tc resonance reaction in the proton energy range 2.00 MeV < Ep < 2.68 MeV. Individual resonances were well resolved with an energy resolution of 1 keV.

28878 (CERN—81-09, pp 253-259) **Nuclear spectroscopy of very proton rich nuclei through H.I. induced reactions: The 14s high spin isomer in ^{95}Pd.** Nolte, E.; Korschinek, G.; Hick, H.; Colombo, G.; Komninos, P.; Gui, S.Z.; Schollmeier, W.; Kubik, P.; Geier, R.; Heim, U. (Technische Univ. Muenchen, Garching (Germany, F.R.). Fakultaet Physik). 20 Jul 1981. Dep. NTIS (US Sales Only).

From 4. international conference on nuclei far from stability; Helsignor, Denmark (7 Jun 1981).

^{40}Ca, ^{58}Ni and ^{60}Ni beams from the Munich tandem and the Munich heavy ion postaccelerator have been used to produce very proton rich nuclei in the N = 50 and n = 82 regions. The residual nuclei have been studied with the help of γ and particle spectroscopy. The level schemes of ^{96}Rh, ^{146}Dy and ^{150}Er and the β-decay schemes ^{95}Pd/sup m/ → ^{95}Rh, ^{144}Tb → ^{144}Gd, ^{148}Ho → ^{148}Dy → ^{148}Tb → ^{148}Gd, ^{148}Er → ^{148}Ho → ^{148}Dy and ^{150}Tm → ^{150}Er → ^{150}Ho → ^{150}Dy have been investigated. β delayed protom emission from a J/sup π/ approx. equal to 21^+ isomeric state in ^{95}Pd has been observed.

28879 (CERN—81-09, pp 276-280) **Beta-delayed two-neutron decay studies for $^{96-99}$Rb.** Reeder, P.L.; Warner, R.A. (Battelle Pacific Northwest Labs., Richland, WA (USA)); Yeh, T.R. (Cornell Univ., Ithaca, NY (USA)); Chrien, R.E.; Gill, R.L.; Liou, H.; Shmid, M.; Stelts, M.L. (Brookhaven National Lab., Upton, NY (USA)). 20 Jul 1981. Dep. NTIS (US Sales Only).

From 4. international conference on nuclei far from stability; Helsignor, Denmark (7 Jun 1981).

Beta-delayed two-neutron emission from $^{96-99}$Rb has been studied by use of the neutron-neutron time correlation technique. Time interval distribution for neutron pulses from a polyethylene moderated neutron counter were measured for mass-separated sources. Coincident neutrons were identified in the time interval distribution by a component having the characteristic residence time of 35 μs for this counter. At mass 98 a coincidence rate well above the correlated background results in a P_2sub(n) for ^{98}Rb of (0.060 +- 0.009)%. Upper limits (2 sigma) for P_2sub(n) of 0.004, 0.008, and 0.024% are reported for ^{96}Rb, ^{97}Rb, and ^{99}Rb, respectively.

28880 (CERN—81-09, pp 281-286) **Collective isospin-spin excitations and Gamow-Teller strength.** Gaarde, C.; Larsen, J.S. (Niels Bohr Inst., Copenhagen (Denmark)); Goodman, C.D.; Foster, C.C. (Indiana Univ., Bloomington (USA)); Goulding, C.A. (Los Alamos National Lab., NM (USA)); Horen, D.J. (Oak Ridge National Lab., TN (USA)); Masterson, T. (Colorado Univ., Boulder (USA)); Rapaport, J.; Taddeucci, T.N. (Ohio Univ., Athens (USA)); Sugarbaker, E. (Ohio State Univ., Columbus (USA)). 20 Jul 1981. Dep. NTIS (US Sales Only).

From 4. international conference on nuclei far from stability; Helsignor, Denmark (7 Jun 1981).

The (p, n) reaction at intermediate energies is a sensitive tool for the study of isospin-spin correlations in nuclei. For heavy nuclei the neutron-spectra are at forward angle dominated by transitions corresponding to excitation of collective states carrying a significant part of total sumrule strength. The zero degree spectra give information on the Gamow-Teller strength distribution. The analysis shows that only 30-50% of the strength is observed, and the coupling to the Δ-resonance could be responsible for part of the missing strength.

28881 (INIS-mf—6819, pp 373) **"OLYMP" program for calculating the cross section of reactions with complex particles by the distorted wave method with finite-range interaction.** Belyaeva, T.L.; Zaikin, P.N.; Zelenskaya, N.S.; Sokolov, A.M.; Teplov, I.B. 1981. (In Russian). Dep. NTIS (US Sales Only).

From 31. conference on nuclear spectroscopy and nuclear structure; Samarkand, USSR (14 Apr 1981).

28882 (INIS-mf—6819, pp 409) **Calculating distributions of final nuclei produced in compound-nucleus reactions on excitation energies, angular momenta and kinematic parameters by means of the Monte Carlo method.** Pasternak, A.A. 1981. (In Russian). Dep. NTIS (US Sales Only).

From 31. conference on nuclear spectroscopy and nuclear structure; Samarkand, USSR (14 Apr 1981).

28883 (INIS-mf—6819, pp 419) **Computer codes for calculating the equilibrium and preequilibrium processes in nuclear reactions.** Smirnov, A.V.; Antropov, A.E. 1981. (In Russian). Dep. NTIS (US Sales Only).

From 31. conference on nuclear spectroscopy and nuclear structure; Samarkand, USSR (14 Apr 1981).

28884 (INIS-mf—6819, pp 420) **LUCIA computer code for processing the experimental data on elastic scattering of heavy ions.** Bragin, V.N. 1981. (In Russian). Dep. NTIS (US Sales Only).

From 31. conference on nuclear spectroscopy and nuclear structure; Samarkand, USSR (14 Apr 1981).

6518 Nuclear Properties And Reactions, A=150-189

REFER ALSO TO CITATION(S) 28871, 28880, 28889

28885 (CERN—81-09, pp 178-182) **First observation of ^{162}Hf decay: completion of an α-decay chain.** Schrewe, U.J.; Hagberg, E.; Schmeing, H.; Hardy, J.C.; Koslowsky, V.; Sharma, K.S.; Clifford, E.T.H. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). 20 Jul 1981. Dep. NTIS (US Sales Only).

From 4. international conference on nuclei far from stability; Helsignor, Denmark (7 Jun 1981).

The new isotope ^{162}Hf (Tsub(1/2) = (37.6 +- 0.8)s) was produced in a ^{142}Nd (^{24}Mg,4n) reaction. The activities produced in this reaction were transported to a measuring station by use of a He-jet system. Decay properties were observed with α-, γ-, and γ-γ - spectroscopy. The Z-assignment of the new isotope was based on a cross bombardment on ^{141}Pr target and on the results of a γ-X-ray coincidence measurement. The mass assignment was deduced from excitation function measurements. From the measured α-decay energy Esub(α) = 4308 (10) keV new mass values were derived for ^{162}Hf, ^{166}W, ^{170}Os, ^{174}Pt, and ^{178}Hg. These new mass values make it possible to establish systematics of two-proton and one-proton binding energies far from stability.

28886 (CERN—81-09, pp 190-201) **Decay studies of new neutron deficient isotopes in the range of elements between gadolinium and lead.** Hofmann, S.; Muenzenberg, G.; Faust, W.; Hessberger, F.; Reisdorf, W.; Schneider, J.R.H.; Armbruster, P. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.)); Guettner, K.; Thuma, B. (Giessen Univ. (Germany, F.R.). 2. Physikalisches Inst.). 20 Jul 1981. Dep. NTIS (US Sales Only).

From 4. international conference on nuclei far from stability; Helsignor, Denmark (7 Jun 1981).

Very neutron deficient isotopes below lead were produced with beams of ^{58}Ni, ^{92}Mo, and ^{107}Ag accelerated by the linear accelerator UNILAC. After separation from the projectile beam by the velocity filter SHIP, the fusion products were implanted with their full recoil energy into an array of position-sensitive detectors. This array is part of a detector system developed for investigation of decay modes of rare isotopes. In a compact geometry α, p, β, γ decay and fission can be observed. With a newly developed position and time correlation technique parent daughter relationships, half lives, and α branching ratios of a large number of isotopes could be determined. Two new α emitting isomeric states could be identified in ^{156}Lu and ^{156}Hf. The energies of the excited states are (1798 +- 12) keV in ^{156}Lu and (1977 +- 18) keV in ^{156}Hf, the half-lives are (2.60 +- 0.07) ms and (444 +- 17) μs, respectively. Compared to the ground state transitions, a hindrance of 10^5 can be deduced for both transitions, possibly indicating orbital angular momenta of the order of 10 h for the α emitting states. The isomers are proposed to belong to shell model isomers beyond ^{146}Gd. A low energetic line at 1.19 MeV was found in the particle spectra taken in reactions of ^{58}Ni + ^{96}Ru → ^{154}Hf. It is tentatively assigned to a proton decay of the new isotope ^{151}Lu.

28887 (CERN—81-09, pp 238-246) **Beta strength function structure in β^+ decay of lutetium, thulium and cesium isotopes.** Alkhazov, G.D.; Bykov, A.A.; Vitman, V.D.; Naumov, Yu.V.; Orlov, S.Yu. (AN SSSR, Leningrad. Inst. Yadernoj Fiziki). 20 Jul 1981. Dep. NTIS (US Sales Only).

From 4. international conference on nuclei far from stability; Helsignor, Denmark (7 Jun 1981).

The spectra of total γ-absorption in the decays of some Lutetium, Thulium and Cesium isotopes have been measured. The probabilities for level population in the decay of the isotopes have been determined. The deduced beta strength functions reveal pronounced structure. Calculations of the strength functions using the Saxon-Woods potential and the residual Gamow-Teller interaction are presented. It is shown that in β^+ decay of light Thulium and Cesium isotopes the strength function comprises more than 70% of the Gamow-Teller excitations with μsub(tau) = +1. This result is the first direct observation of the Gamow-Teller resonance in β^+ decay of nuclei with Tsub(z) > O.

28888 (LYCEN—8102, pp S2.1-S2.9) **Nuclear behaviour at high angular momentum and 4π gamma detectors.** Beck, F.A. (Strasbourg-1 Univ., 67 (France). Centre de Recherches Nucleaires). [nd]. (In French). Dep. NTIS (US Sales Only).

From 6. biannual session of nuclear physics; Aussois, France (2 Feb 1981).

In this paper are first briefly summarized the technical developments which have recently allowed important progress in the knowledge of nuclear behaviour at high angular momentum as well for the experimental results as for the theoretical explanations. As an example the case of ^{156}Er nucleus is described; the use of a sum crystal in the ^{122}Sb(^{37}Cl,4n)^{156}Er reaction permit to establish the excited states of the yrast line up to J = 32h with a well pronounced irregularity in the variation of the moment of inertia versus the rotational frequency. A 4π gamma detector project, of crystal ball type, is then described.

6519 Nuclear Properties And Reactions, A=190-219

REFER ALSO TO CITATION(S) 28868, 28880

28889 (CERN—81-09, pp 174-177) **Alpha-decay rates of even-even lead isotopes.** Toth, K.S.; Ellis-Akovali, Y.A.; Moltz, D.M. (Oak Ridge National Lab., TN (USA)); Bingham, C.R. (Tennessee Univ., Knoxville (USA)); Ijaz, M.A. (Virginia Polytechnic Inst. and State Univ., Blacksburg (USA)); Lin, J. (Tennessee Technological Univ., Cookeville (USA)); Sousa, D.C. (Eastern Kentucky Univ., Richmond (USA)); Carter, H.K.; Mlekodaj, R.L.; Spejewski, E.H. 20 Jul 1981. Dep. NTIS (US Sales Only).

From 4. international conference on nuclei far from stability; Helsignor, Denmark (7 Jun 1981).

The α-decay rates of ^{188,189,190,192}Pb have been reported to have an anomalous dependence on neutron number. Theoretical calculations do not reproduce this unusual behavior. To obtain more precise α-decay branching ratios, we reinvestigated the decay properties of ^{188,190,192}Pb. Our data result in α-decay reduced widths whose dependence on N is similar to that observed for other elements.

28890 (CERN—81-09, pp 56-61) **Study of the charge radii of the stable lead isotopes.** Borchert, G.L.; Schult, O.W.B.; Speth, J. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Kernphysik); Hansen, P.G. (Aarhus Univ. (Denmark). Inst. of Physics); Jonson, B.; Ravn, H. (European Organization for Nuclear Research, Geneva (Switzerland). ISOLDE Collaboration); McGrory, J.B. (Oak Ridge National Lab., TN (USA)). 20 Jul 1981. Dep. NTIS (US Sales Only).

From 4. international conference on nuclei far from stability; Helsignor, Denmark (7 Jun 1981).

Isotope shifts have been measured of the $K\alpha_1$ X-ray lines emitted after photo ionization of ^{204}Pb, ^{206}Pb, ^{207}Pb and ^{208}Pb samples. The results are compared with theoretical values for delta$<r^2>$ calculated with a microscopic model. The X-ray shift data are also compared with optical data and the nuclear parameters lambda derived from electron scattering results.

28891 (CERN—81-09, pp 183-189) **Time-differential observation of α-particle perturbed angular distribution: g-factor measurements for ^{217}Ac/sup gs/ and ^{217}Ac/sup m/.** Maier, K.H.; Decman, D.J.; Grawe, H.; Kluge, H. (Hahn-Meitner-Institut fuer Kernforschung Berlin G.m.b.H. (Germany, F.R.). Bereich Kern- und Strahlenphysik). 20 Jul 1981. Dep. NTIS (US Sales Only).

From 4. international conference on nuclei far from stability; Helsignor, Denmark (7 Jun 1981).

The g-factor measurements of the ground state and an isomeric level in ^{217}Ac using the DPAD method with α-decay are described in this work. The results of γ-ray g-factor measurements for the isomer and a tentative decay scheme produced by α-γ and γ-γ coincidence experiments are also presented. An analysis of the α-particle angular distributions suggests that nuclear deformation affects the observed anisotropy.

6520 Nuclear Properties And Reactions, A=220 And Above

REFER ALSO TO CITATION(S) 28858

28892 (CERN—81-09, pp 260-264) **Beta-delayed fission and calculations of the beta strength function.** Krumlinde, J.; Mueller, P.; Wene, C.O. (Lund Univ. (Sweden). Dept. of Physics; Lund Univ. (Sweden). Dept. of Mathematical Physics); Howard, M. (California Univ., Livermore (USA). Lawrence Livermore National Lab.). 20 Jul 1981. Dep. NTIS (US Sales Only).

From 4. international conference on nuclei far from stability; Helsignor, Denmark (7 Jun 1981).

The different decay modes of neutron-rich heavy nuclei are of considerable interest for a wide range of physical phenomena. The study of these decay modes involves information about several properties of the nucleus where at the moment more knowledge about the beta strength function is particularly wanted. In this paper microscopic calculations of the beta strength are described and the sensibility of the beta-delayed fission branching ratios and the production ratios of cosmochronometric pairs to different shapes of the beta strength function are discussed.

28893 (CERN—81-09, pp 287-291) **Strength functions for charge-exchange nuclear excitations.** Fayans, S.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii); Pyatov, N.I. (Joint Inst. for Nuclear Research, Dubna (USSR)). 20 Jul 1981. Dep. NTIS (US Sales Only).

From 4. international conference on nuclei far from stability; Helsignor, Denmark (7 Jun 1981).

In the present work the theory of finite Fermisystems is applied to description of the multipole (S = O) and spin-multipole (S = 1) charge-exchange nuclear excitations. The experimental data on the isobaric analog states (IAS) and Gamow-Teller resonances (GTR) recently obtained from the (p, n) studies are used to specify some characteristics of the charge-exchange effective interactions which are then employed to predict properties of the L = 1, 2, 3 resonances. The calculations have shown that to reproduce the observed energy of IAS and its escape width, one should introduce the strong density dependence in the isovector interaction. Such a density dependence affects noticeably the energies of other multipole resonances. The influence of the one-pion-exchange potential on the S = 1 resonances is studied. The value of the Landau-Migdal parameter g' is deduced by comparing the calculated energies of the GTR with the experimental ones. The dependence of the strength functions on the momentum transfer is also studied. Our calculations have shown that the S = O and S = 1 resonances with the same spin and parity possess quite different properties. The microscopic calculations were carried out for such isobaric pairs as ^{56}Fe- ^{56}Co, ^{90}Zr- ^{90}Nb and ^{208}Pb- ^{208}Bi but in this short report we discuss mainly the results obtained for the latter case.

28894 (INIS-SU—38, pp 82-95) **U^{235} and Pu^{239} fission product yields by neutrons of the BR-1 fast reactor spectrum.** Byalko, A.A.; Gudkov, A.N.; Zhivun, V.M. 1978. (In Russian). Dep. NTIS (US Sales Only).

In Experimental methods in nuclear physics. No. 3. Collection of scientific papers.

Fission product yield of uranium-235 and plutonium-239 by neutrons of the fast reactor spectrum has been investigated. The irradiated uranium-235 samples have been performed in the form of tablets of uranium-235 dioxide with 90% enrichment, and the plutonium-239 samples presented a mixture of fine ground plutonium-239 preparation with aluminium powder as a filler. The sample irradiation time constitutes 821 min for uranium-235 and 854 min - for plutonium-239. The neutron fluence equals approximately 5-10^9 neutr/cm^2. The scheme of a measuring complex applied for gammma-spectrometric investigations of irradiated samples is given. Principal complex elements are Ge(Li)-detector of 30 cm^3 volume, charge-sensitive preamplifier, spectrometric amplifier, multichannel amplitude analyzer and teletype. Energy resolution of the spectrometer constitutes 4.5 keV on 662 keV line cesium-137. Fission product yields values have been found by the analysis of count rate change in time. As a result of the analysis of experimental information the cummulative yields of seven fission products have been determined: yttrium-91 m, iodine-131, tellurium-132, iodine-133, iodine-135, xenon-135, zerium-143. Tables are given with cumulative fission yield values f uranium-235 and plutonium 239, obtained in the given experiment and taken from other studies.

28895 (LYCEN—8102, pp C10.1-C10.13) **Recent progress in nuclear fission.** Leroux, B.; Barreau, G.; Benfoughal, T.; Caitucoli, F.; Carjan, N.; Doan, T.P.; Sicre, A. (Bordeaux-1 Univ., 33 - Gradignan (France). Centre d'Etudes Nucleaires). [nd]. (In French). Dep. NTIS (US Sales Only).

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Important progress have been performed during the last years in nuclear fission; some results are presented to illustrate these progress.

28896 (LYCEN—8102, pp S14.1-S14.5) **Recent progress in fission at saddle point and scission point.** Blons, J.; Paya, D.; Signarbieux, C. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Service de Physique Nucleaire a Moyenne Energie). [nd]. (In French). Dep. NTIS (US Sales Only).

From 6. biannual session of nuclear physics; Aussois, France (2 Feb 1981).

High resolution measurements of ^{230}Th and ^{232}Th fission cross sections for neutrons exhibit a fine structure. Such a structure is interpreted as a superposition of two rotational bands in the third, asymmetric, well of the fission barrier. The fragment mass distribution in the thermal fission of ^{235}U and ^{233}U does not show any even-odd effect, even at the highest kinetic energies. This is the mark of a strong viscosity in the descent from saddle point to scission point.

6530 Nuclear Theory

28897 (CERN—81-09, pp 65-70) **Liquid-drop type expansion of nuclear binding and deformation energies with Skyrme forces.** Brack, M.; Guet, C.; Hakansson, H.B. (Regensburg Univ. (Germany, F.R.). Inst. fuer Physik 1 - Theoretische Physik); Magner, A.; Strutinsky, V.M. (AN Ukrainskoj SSR, Kiev. Inst. Yadernykh Issledovanij). 20 Jul 1981. Dep. NTIS (US Sales Only).

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Starting from the energy density formalism with effective Skyrme forces, we show how a liquid drop model like expansion of the nuclear binding energy can be systematically obtained. For a model Skyrme force with constant effective nucleon mass, all liquid drop parameters of symmetric nuclei can be given analytically in

terms of the Skyrme parameters. Numerical tests of the leptodermous expansion are presented.

28898 (CERN—81-09, pp 71-74) **Nuclear bulk properties calculated from effective Skyrme interactions: How far can they be extrapolated.** Brack, M. (Regensburg Univ. (Germany, F.R.). Inst. fuer Physik 1 - Theoretische Physik). 20 Jul 1981. Dep. NTIS (US Sales Only).

From 4. international conference on nuclei far from stability; Helsignor, Denmark (7 Jun 1981).

The present status of Skyrme-Hartree-Fock calculations of nuclear bulk properties is briefly reviewed. Comparison is made to the liquid drop plus shell-correction approach and to semiclassical methods.

28899 (CERN—81-09, pp 81-89) **Self-consistent study of nuclei far from stability with the energy density method.** Tondeur, F. (Institut Superieur Industriel de Bruxelles (Belgium); Brussels Univ. (Belgium)). 20 Jul 1981. Dep. NTIS (US Sales Only).

From 4. international conference on nuclei far from stability; Helsignor, Denmark (7 Jun 1981).

The self-consistent energy density method has been shown to give good results with a small number of parameters for the calculation of nuclear masses, radii, deformations, neutron skins, shell and subshell effects. It is here used to study the properties of nuclei far from stability, like densities, shell structure, even-odd mass differences, single-particle potentials and nuclear deformations. A few possible consequences of the results for astrophysical problems are briefly considered. We also summarise the predictions of the model in the super-heavy region.

28900 (CERN—81-09, pp 90-92) **Effect of deformation and the neutron skin on RMS charge radii.** Myers, W.D. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.); Schmidt, K.H. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.)). 20 Jul 1981. Dep. NTIS (US Sales Only).

From 4. international conference on nuclei far from stability; Helsignor, Denmark (7 Jun 1981).

Droplet Model predictions for nuclear RMS charge radii are compared with measured values in order to determine whether or not there is any evidence for volume shell effects. After corrections for deformation, diffuseness, and the central depression have been applied, some evidence for such effects remains, but it is at about the same level as the experimental uncertainty.

28901 (CERN—81-09, pp 93-104) **Nuclear masses and nuclear structure.** Zeldes, N. (Hebrew Univ., Jerusalem (Israel). Racah Inst. of Physics). 20 Jul 1981. Dep. NTIS (US Sales Only).

From 4. international conference on nuclei far from stability; Helsignor, Denmark (7 Jun 1981).

We discuss microscopical interpretations of nuclear mass systematics, emphasizing aspects having relevance to nuclei far from stability.

28902 (CERN—81-09, pp 229-237) **Nuclear level densities with pairing and self-consistent ground-state shell effects.** Arnould, M. (Brussels Univ. (Belgium). Inst. d'Astronomie et d'Astrophysique); Tondeur, F. (Vrije Univ. Brussel (Belgium); Institut Superieur Industriel de Bruxelles (Belgium)). 20 Jul 1981. Dep. NTIS (US Sales Only).

From 4. international conference on nuclei far from stability; Helsignor, Denmark (7 Jun 1981).

Nuclear level density calculations are performed using a model of fermions interacting via the pairing force, and a realistic single particle potential. The pairing interaction is treated within the BCS approximation with different pairing strength values. The single particle potentials are derived in the framework of an energy-density formalism which describes self-consistently the ground states of spherical nuclei. These calculations are extended to statically deformed nuclei, whose estimated level densities include rotational band contributions. The theoretical results are compared with various experimental data. In addition, the level densities for several nuclei far from stability are compared with the predictions of a back-shifted Fermi gas model. Such a comparison emphasizes the possible danger of extrapolating to unknown nuclei classical level density formulae whose parameter values are tailored for known nuclei.

28903 (CERN—81-09, pp 12-25) **Nuclear single-particle structure derived from spins and moments of long isotopic chains.** Ekstroem, C. (Chalmers Tekniska Hoegskola, Goeteborg (Sweden). Dept. of Physics; Goeteborg Univ. (Sweden). Institutionen foer Fysik). 20 Jul 1981. Dep. NTIS (US Sales Only).

From 4. international conference on nuclei far from stability; Helsignor, Denmark (7 Jun 1981).

Experimental data on nuclear spins and moments of long isotopic chains are compared with results from theoretical calculations within a particle-rotor approach based on the Nilsson model. The comparison allows a systematic mapping of the nuclear single-particle structure of ground and isomeric states, revealing structural and nuclear shape variations along the isotopic sequences studied.

28904 (CERN—81-09, pp 33-41) **Systematics of radii and nuclear charge distributions deduced from elastic electron scattering, muonic X-ray and optical isotope shift measurements.** Emrich, H.J.; Fricke, G.; Mallot, M.; Miska, H.; Rychel, D. (Mainz Univ. (Germany, F.R.). Inst. fuer Kernphysik); Hoehn, M. (Los Alamos Scientific Lab., NM (USA)); Kaeser, K.; Robert-Tissot, B.; Schaller, L.; Schellenberg, L. (Fribourg Univ. (Switzerland). Inst. de Physique). 20 Jul 1981. Dep. NTIS (US Sales Only).

From 4. international conference on nuclei far from stability; Helsignor, Denmark (7 Jun 1981).

The nuclear charge distribution and nuclear charge distribution differences have been investigated by 350 MeV elastic electron scattering at the Institut fuer Kernphysik, Universitaet Mainz. Muonic X-ray measurements yield complementary information to electron scattering results. Both experimental data are analysed in an almost model independent way. Muonic X-ray measurements have been performed for the region ^{40}Ca up to ^{100}Mo.

28905 (LYCEN—8102, pp C17.1-C17.16) **Towards a microscopic description of nuclear fission.** Quentin, P. (Institut National de Physique Nucleaire et de Physique des Particules, 75 - Paris (France)). [nd]. (In French). Dep. NTIS (US Sales Only).

From 6. biannual session of nuclear physics; Aussois, France (2 Feb 1981).

Theoretical investigations aiming at a microscopic description of nuclear fission are reviewed. Only those descriptions making explicitely use of effective nucleon-nucleon interactions are meant as microscopic descriptions. Results obtained so far as well as possible developments in a near future are discussed for both static and dynamic approaches.

28906 (LYCEN—8102, pp S1.1-S1.8) **π-3N few body problem.** Avishai, Y. (Ben-Gurion Univ. of the Negev, Beersheba (Israel). Dept. of Physics); Mizutani, T. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire; Lyon-1 Univ., 69 - Villeurbanne (France). Inst. de Physique Nucleaire). [nd]. Dep. NTIS (US Sales Only).

From 6. biannual session of nuclear physics; Aussois, France (2 Feb 1981).

The interest in pion induced nuclear reaction resulted in a considerable experimental and theoretical progress. In general, the many body problem cannot be solved exactly, and one resorts to some kind of multiple scattering theory (e.g., microscopic model). However, for systems with few nucleons (especially for π-2N systems) several authors have developed complete theories which yield numerically solvable equations. The connection between theories of pion-few nucleon systems and the pion nucleus many body problem is now under intensive study. Hence, the motivation for studying the physics of pion-few nucleon systems is obvious.

28907 (LYCEN—8102, pp S9.1-S9.8) **N-N and π-N scattering within a separable approach to the Bethe-Salpeter equation.** Froelich, J.; Schwarz, K. (Graz Univ. (Austria). Inst. fuer Theoretische Physik). [nd]. Dep. NTIS (US Sales Only).

From 6. biannual session of nuclear physics; Aussois, France (2 Feb 1981).

We present nucleon-nucleon phase shifts for $l = 0$, 1 and 2, using a separable approximation to the Bethe-Salpeter equation. In addition, we present a calculation of the resonant P_{33} partial wave of the pion-nucleon system. Our results are in good agreement with the experimental data.

28908 (LYCEN—8102, pp S6.1-S6.5) **Large scale and small scale energy transport in relativistic nuclear reactions.** Cugnon, J. (Liege Univ. (Belgium). Inst. de Physique Nucleaire). [nd]. Dep. NTIS (US Sales Only).

From 6. biannual session of nuclear physics; Aussois, France (2 Feb 1981).

The possibility of large scale and small scale energy transport between nucleons during relativistic collision process is examined and critically discussed in view of recent Monte-Carlo calculations. Deviations from a purely hydrodynamical motion are exhibited.

6540 Radiation And Shielding Physics

REFER ALSO TO CITATION(S) 27785, 28010, 28287

28909 (INIS-SU—25, pp 47-51) **Error evaluation of Monte Carlo calculations.** Klimanov, V.A.; Luk'yanov, M.A.; Makhon'kov, A.S.; Mashkovich, V.P.; Tsofin, V.I. 1979. (In Russian). Dep. NTIS (US Sales Only).

From 2. all-union conference on ionizing radiation protection of industrial nuclear plants; Moscow, USSR (19 Dec 1978).

Possibilities of the RNZ computer codes complex developed for error analysis of neutron and gamma field calculations in the inhomogeneities of nuclear shields are discussed. The algorithm is based on the Monte Carlo method and the differential albedo concept. The error sources are broken into 3 groups: errors caused by the calculational technique, interaction constants errors and due to uncertainties of initial data of the problem. The discussion is conducted on the example of a 3-sectioned curved cylindrical reactor channel, in the inlet of which there is a source of 1.25 MeV gamma radiation or fission neutrons. Some results on the errors of the neutron and gamma field calculation due to specific error sources are presented. It is pointed out that the technique and algorithms developed are applicable practically to any problem of the sort.

28910 (INIS-SU—25, pp 51-56) **Sensitivity study in neutron albedo and quasialbedo calculations.** Klimanov, V.A.; Makhon'kov, A.S.; Mashkovich, V.P.; Stroganov, A.A. 1979. (In Russian). Dep. NTIS (US Sales Only).

From 2. all-union conference on ionizing radiation protection of industrial nuclear plants; Moscow, USSR (19 Dec 1978).

The sensitivity of calculational differential and integral neutron albedo and quasialbedo characteristics in different media to cross section errors and (in the case of quasialbedo) to the medium composition has been studied. Main results are presented. Variations of the total neutron cross sections for a semi-infinite iron reflector by +-10% have not changed the integral albedo characteristics. In the case the errors that might be caused by uncertainties in the differential cross sections are negligible. Analytical relationships are presented that describe the sensitivity of the current integral dose (energy, numerical) quasialbedo to variations of the partial neutron cross sections for light media, neutron source characterisitics and concentration of different nuclides in the media.

28911 (INIS-SU—25, pp 99-102) **Study of the reactor fast neutron transport in stainless steels and titanium barriers.** Aleksandrov, V.L.; Evfanov, V.Ya.; Madeev, V.G.; Nikol'skii, V.A.; Uksusov, E.I.; Utkin, V.A. 1979. (In Russian). Dep. NTIS (US Sales Only).

From 2. all-union conference on ionizing radiation protection of industrial nuclear plants; Moscow, USSR (19 Dec 1978).

The results of theoretical and experimental investigations of fast neutron transport through the Type 12 Kh18N10T stainless steel (rho=7.85 g/cm^3) and titanium (rho=4.34 g/cm^3) barriers are presented. The calculations were carrried out with the help of the ROZ computer code and the ARAMAKO-2F data library. The experiments were performed on the OR-M facility. The data on the neutron flux attenuation functions and the dependence of the neutron scattering functions on the neutron emission angle are reported. The comparison of the calculated and experimental results have demonstrated a satisfactory agreement for the titanium barrier of the investigated thickness (up to 12 cm). Meanwhile in the case of the steel barrier, the scattering cross sections indicatrix and the total group cross sections in the ARAMAKO-2F library for the elements composing the stainless steel should be verified.

28912 (INIS-SU—25, pp 113-117) **Study of the radiative heat release in an iron prism.** Bakov, A.T.; Kuzin, E.N.; Lityaev, V.M.; Musaev, R.A.; Ryabaya, L.D.; Sokolov, M.M. 1979. (In Russian). Dep. NTIS (US Sales Only).

From 2. all-union conference on ionizing radiation protection of industrial nuclear plants; Moscow, USSR (19 Dec 1978).

Neutron and gamma fluxes, and the radiation heating in an iron cylindrical prism have been experimentally and theoretically studied. The measurements were performed on an experimental fuel assembly at the BFS mockup. There was metallic uranium enriched to about 5.6% of ^{235}U in the center of the assembly. The radial fission density distributions and the neutron and gamma spectra were measured in different points of the assembly. The axial radiation heating density distribution was also obtained. The experimental and calculated spectra are consistent with the exception of the gamma energy range E<2 MeV. The data on the radiation heating are also agreeable. The contribution of the capture gamma radiation into the radiation heating amounts to 65%.

28913 (INIS-SU—25, pp 122-130) **Calculational and experimental study of the shield mock-ups characteristics.** Bylkin, B.K.; Vasil'ev, G.A.; Erkin, D.G.; Pankratov, D.V.; Sukharev, N.N.; Shestakov, V.P. 1979. (In Russian). Dep. NTIS (US Sales Only).

From 2. all-union conference on ionizing radiation protection of industrial nuclear plants; Moscow, USSR (19 Dec 1978).

Characteristics of multilayer heterogeneous biological shields have been experimentally and theoretically studied. The study has been fulfilled on two compositions: "dry" shield (steel-lead-aluminium-boron carbide-aluminium) and "wet" shields (steel-lead-aluminium-boron carbide-water-aluminium). The experiments were performed in a cavity of the IR-50 reactor. The neutron field was calculated by the diffusion method. The data on neutron and gamma dose rates are presented, as well as on the fast and thermal neutron flux spatial distributions. In the whole there is a good agreement between the calculated and measured values. The results of search for an optimum "dry" composition ensuring minimum dose rates at the external surface are also presented.

28914 (INIS-SU—25, pp 164-168) **Calculation of the shadow cone collimation figure for fast fission neutrons.** Aleksandrov, V.L.; Madeev, V.G.; Uksusov, E.I.; Utkin, V.A.; Cheshigin, I.V. 1979. (In Russian). Dep. NTIS (US Sales Only).

From 2. all-union conference on ionizing radiation protection of industrial nuclear plants; Moscow, USSR (19 Dec 1978).

An algorithm is proposed for phenomenological calculation of the reactor spectrum neutron fields behind a shadow cone. The algorithm is based on the two-component technique, the well-known ray technique and the multigroup ROZ-5 computer code using the ARAMAKO-2F data bank. With the help of the method proposed the spatial and angular neutron flux distributions of the direct and scattered neutrons can be calculated inside and on the boundaries of the cone in a wide energy range from 0.1 to 10.5 MeV. Some results of the calculations performed for neutron energies above 0.1 and 2.5 MeV and the cone made of borated paraffin are reported. It is stated that the calculations carried out made it possible to determine the collimation figure of the absorbing cone with the account of the structural frames.

28915 (INIS-SU—25, pp 179-184) **Application of group constants in neutron and gamma field calculations by the Monte Carlo method.** Zhezlov, A.M.; Klimanov, V.A.; Makhon'kov, A.S.; Pavlov, G.M.; Stroganov, A.A. 1979. (In Russian). Dep. NTIS (US Sales Only).

From 2. all-union conference on ionizing radiation protection of industrial nuclear plants; Moscow, USSR (19 Dec 1978).

The expediency of group constant application in Monte Carlo calculations of radiation transport has been investigated. The BSN-F computer code has been developed for the BESM-6 computer to calculate neutron fields in an infinite uniform media. The group constants were calculated with the help of the ARAMAKO-2F library. The calculations of neutron flux spectra from isotropic neutron sources in the energy range of 4-6.5 MeV and fission neutrons of ^{252}Cf in air and liquid air, were performed and are compared to those carried out by the ANISN code and to experimental data. The ANISN code uses the discrete ordinate method in the $S_{16}P_5$ approximation. Analysis of the comparison brought about a conclusion that the application of group constants is efficient from the viewpoint of decreasing the information needed on cross sections and computation time.

28916 (INIS-SU—25, pp 63-67) **Calculation of the secondary gamma radiation by the Monte Carlo method at displaced sampling from distributed sources.** Petrov, E.E.; Fadeev, I.A. 1979. (In Russian). Dep. NTIS (US Sales Only).

From 2. all-union conference on ionizing radiation protection of industrial nuclear plants; Moscow, USSR (19 Dec 1978).

A possibility to use displaced sampling from a bulk gamma source in calculating the secondary gamma fields by the Monte Carlo method is discussed. The algorithm proposed is based on the concept of conjugate functions alongside the dispersion minimization technique. For the sake of simplicity a plane source is considered. The algorithm has been put into practice on the M-220 computer. The differential gamma current and flux spectra in 21cm-thick lead have been calculated. The source of secondary gamma-quanta was assumed to be a distributed, constant and isotropic one emitting 4 MeV gamma quanta with the rate of 10^9 quanta/cm^{3}xs. The calculations have demonstrated that the last 7 cm of lead are responsible for the whole gamma spectral pattern. The spectra are practically coincide with the ones calculated by the ROZ computer code. Thus the algorithm proposed can be effectively used in the calculations of secondary gamma radiation transport and reduces the computation time by 2-4 times.

28917 (INIS-SU—25, pp 68-72) **Monte Carlo calculation of the capture gamma sources distribution in a 3-layer barrier.** Sakovich, V.A.; Sakharov, V.M.; Sidorenko, L.L.; Khisamutdinov, A.I. 1979. (In Russian). Dep. NTIS (US Sales Only).

From 2. all-union conference on ionizing radiation protection of industrial nuclear plants; Moscow, USSR (19 Dec 1978).

The depth distribution of capture gamma sources (rhosub(γ)) at slanting incidence of neutrons onto a shielding barrier has been calculated by the Monte Carlo method using the OFORZ computer code. A broad unidirectional neutron beam of a specific spectrum (in the 1-14 MeV range) bombarded the 3-layer barrier. The thickness of the first iron layer varied and did not exceed 28 cm in the beam direction. The thicknesses of the second (boron carbide) and the third (polyethylene) layers were constant and ammounted to 2 and 30 cm, respectively. The results of rhosub(γ) calculations in the iron layer at incident angles $THETA_0$ of 0, 45 and 60 are presented in hystogrammes. The errors are evaluated as 10-20% at $THETA_0$=0deg) and 15-30% at $THETA_0$=45, 60 deg. The calculational time of a single variant (given $THETA_0$) on the BESM-6 computer equals 3.5-4 hr. The rhosub(γ) distributions are consistent with those calculated elsewhere using the ROZ-1 code.

28918 (INIS-SU—25, pp 102-106) **Gamma spatial and energy distribution in lithium hydride.** Korolev, E.N.; Papin, V.K.; Rubtsov, I.N.; Solov'ev, B.A. 1979. (In Russian). Dep. NTIS (US Sales Only).

From 2. all-union conference on ionizing radiation protection of industrial nuclear plants; Moscow, USSR (19 Dec 1978).

Some shielding properties of lithium hydride have been experimentally studied on the OR-M facility. The WWR-3000 kW(th.) reactor served as the gamma source. The cylindrical LiH blocks were 900 mm in diameter and 100-1380 mm thick. The space dependence of the gamma dose rate behind the blocks, the angular distribution of the scattered gamma radiation and the gamma spectra were measured. Using the data the gamma dose rate attenuation curve and the gamma currrent scattering function have been calculated. The corresponding calculations conducted for LiH blocks with the thickness of 55 cm and 138 cm resulted in values coinciding with the experimental data within the +-20% error bars for the distances from the reactor center up to 10m.

28919 (INIS-SU—25, pp 106-112) **Energy and angular distribution of gamma flux and dose rate behind water barriers of different thickness.** Kiselev, Yu.V.; Kozlovskii, S.A.; Kuchin, N.L.; Popkov, K.K.; Rubanov, S.M.; Titov, V.I.; Trofimov, I.N. 1979. (In Russian). Dep. NTIS (US Sales Only).

From 2. all-union conference on ionizing radiation protection of industrial nuclear plants; Moscow, USSR (19 Dec 1978).

The angular and energy distributions of a 0.16-9.0 MeV broad gamma beam behind water barriers of different thickness (up to 450 cm) have been experimentally and theoretically studied. The experiments were performed on a research water-water reactor with the maximum power rate of 50 kW. The calculations were conducted by the Karlson method realized in the S_8P_8 approximation by and the KURAGA-M computer code. The total errors of the measurements were evaluated to be about 30% in the range from 0.16 MeV to 0.64 MeV and to increase to 50% at higher energies and scattering angles THETA >40 deg. The gamma spectra were found to soften with increasing energy, whereas the angular spectra-to harden with increasing thickness. As the thickness increases the shape of the angular energy spectra varies but little. The comparison of the calculated and experimental data testifies to a satisfactory agreement of the angular spectra for water thickness up to 350 cm.

28920 (INIS-SU—25, pp 148-151) **Numerical calculation of the bremsstrahlung spectrum emitted from thick targets, for initial electron energies 0.01 to 30 MeV.** Baranov, V.F.; Demin, V.M.; Smirnov, V.V.; Shmatko, V.G. 1979. (In Russian). Dep. NTIS (US Sales Only).

From 2. all-union conference on ionizing radiation protection of industrial nuclear plants; Moscow, USSR (19 Dec 1978).

An algorithm proposed elsewhere is realized, which allows one to determine the bremsstrahlung spectra at different angles to the target perpendicular as a function of the incident electron energy E_0 (in the 0.01-30 MeV range), the target thickness and material. Unlike earlier studies new empirical relationships for the electron transmission coefficients were used. As an example the results of the gamma bremsstrahlung calculations for iron, gold and aluminium targets, E_0=2.8 MeV and the observation angular range from 0 to 30 deg, are presented. It is concluded that the spectra calculated satisfactorily follow the patterns of the experimental curves under small angles (0-30 deg).

28921 (INIS-SU—52, pp 54-63) **Statistical method for calculating the characteristic parameters of the electron transport process in a medium.** Erokhin, K.M.; Mashinin, V.A. 1979. (In Russian). Dep. NTIS (US Sales Only).

In Radiation technology. Issue 17.

A statistical method for calculating parameters of electron transport in a medium is proposed. Application of the method for calculation of the mean value of the electron trajectory projection in a medium on the initial direction of electron motion has been investigated. An analytical solution of the kinetic equation in the few group approximation at small thicknesses of a substance has been obtained. It is stressed that the proposed calculation method may include also rare events involving scattering to a great angle. A conclusion has been drawn that the selection of a correct statistical hypothesis and calculation of necessary moments make it possible to obtain, with an adequate accuracy, the expressions for such important parameters as the transparence and reflection coefficients.

28922 (INIS-SU—57, pp 7-14) **Sliding rule-nomogram for calculation of a shield from extended radioisotope gamma sources.** Terent'ev, B.M. 1980. (In Russian). Dep. NTIS (US Sales Only).

In Radiation techniques. Issue 19. Questions of nuclear science and techniques.

Arrangement of sliding rule-nomogram, intended for calculation of side protection in radial direction from γ-radiation of extended radioisotopic sources (^{60}Co and ^{137}Cs) is described. The sliding rule-nomogram comprises rule itself (body) with monograms plotted on it, first slide independently moving along the body of the rule, and second slide with sighting line independently sliding along the first slide perpendicular to its movement. The principle of operation of the slide rule-nomogram is considered in detail. Calculation examples of protective device by means of the rule-nomogram are presented. The rule is suitable and simple in operation. Any of the radiation parameters (protection thickness, protection material, activity, source energy, air gap) can be operatively determined by means of this rule.

28923 (INIS-SU—87, pp 198) **Space-energy and angular distributions of neutrons and gamma quanta in lead and graphite.** Broder, D.L.; Gureev, V.I.; Leshchiner, M.E.; Khandurov, N.V. (Moskovskij Ehnergeticheskij Inst. (USSR)). 1981. (In Russian). Dep. NTIS (US Sales Only).

From 2. all-union conference on engineering problems of thermonuclear reactors; Leningrad, USSR (23 Jun 1981).

6550 Medical Physics

REFER ALSO TO CITATION(S) 28430, 28615, 28652

28924 (CONF-801082—6) **Experimental validation of Monte Carlo calculations for organ dose.** Yalcintas, M.G.; Eckerman, K.F.; Warner, G.G. (Oak Ridge National Lab., TN (USA)). 1980. Contract W-7405-ENG-26. 20p. NTIS, PC A02/MF A01. Order Number DE82002778.

From ORAU radiopharmaceutical dosimetry symposium; Oak Ridge, TN, USA (6 Oct 1980).

The problem of validating estimates of absorbed dose due to photon energy deposition is examined. The computational approaches used for the estimation of the photon energy deposition is examined. The limited data for validation of these approaches is discussed and suggestions made as to how better validation information might be obtained. (ACR)

28925 (ISS-P—80/5) **The introduction of the sievert into the international system of units.** Salvadori, P. (Istituto Superiore di Sanita, Rome (Italy)). Apr 1980. 15p. (In several languages). NTIS, PC A02/MF A01.

The international system of units and its adoption by Italy are discussed, with particular emphasis on the unit for equivalent radiation dose known as the Sievert. The danger of confusion between absorbed dose and equivalent dose measurements is brought up, justifying the adoption of the proposed unit. (ESA)

28926 (PNL—4100-Pt.4, pp 51-53) **Microdosimetry.** Feb 1982. NTIS, PC A06/MF A01.

In Pacific Northwest Laboratory annual report for 1981 to the DOE Office of Energy Research. Part 4. Physical sciences.

Projects in microdosimetry and cellular effects are closely integrated and have the joint purpose of exploring the connections between the primary physical events produced by radiation and their biological consequences in cellular systems. The microdosimetry projects include the theoretical description of primary events and their connection with the observable biological effect. Microdosimetric spectra for 2 MeV electron beams in one- and two- micrometer sites have been measured directly. Work on calculating the energy deposition in site sizes and geometries that cannot be measured has led to publication of a paper on proton-induced ionization in nanometer sites. Emphasis in these calculations has now shifted to electron beams.

28927 (UCRL—52000-82-2, pp 11-18) **LLNL X-ray Calibration and Standards Laboratory.** Feb 1982. NTIS, PC A03/MF A01.

In Energy and technology review.

The LLNL X-ray Calibration and Standards Laboratory is a unique facility for developing and calibrating x-ray sources, detectors, and materials, and for conducting x-ray physics research in support of our weapon and fusion-energy programs.

6560 Solid State Physics

28928 **Method for evaluation of dislocation strain energy and self force.** Scattergood, R.O. (Argonne National Lab., IL). *Acta Metallurgica;* **28**: 1703-1714(1980).

A new cutoff procedure was developed for the evaluation of the strain energy associated with a general curvilinear dislocation in an infinite homogeneous linear-elastic anisotropic body. When used in conjunction within the geometric-theorem approach for dislocation stress fields, a convenient and self-consistent prescription for the complete infinite-body self force is obtained. This kind of prescription will be needed to determine the true equilibrium shape of a dislocation with the framework of linear-elastic dislocation theory. The present method has the same essential physical features as an earlier approach due to Barnett and Gavazza. In addition, the method allows a simple double-line integral formula for the strain energy to be derived, which may prove useful in applications.

6561 Superconductivity

REFER ALSO TO CITATION(S) 28144

6570 Theoretical Physics

28929 (BNL—51443(Vol.2), pp 592-599) **Possible test of general relativity at ISABELLE.** Reece, C.E.; Melissinos, A.C.; Reiner, P. (Univ. of Rochester, NY). 1981. NTIS, PC A18/MF A01.

From Physics opportunities at ISABELLE summer workshop; Upton, NY, USA (20 Jul 1981).

The deflection of light rays passing in the vicinity of the sun provided the first experimental confirmation of the theory of general relativity. Analogous experiments may become possible in the laboratory using the stored beam of a high energy, high current machine such as ISABELLE. Instead of observing the deflection of the beam it appears more practical to detect the effect of the beam on a stationary detector.

70 FUSION ENERGY

7001 Plasma Research

28930 (CONF-801119—, pp vp) **Ballooning mode growth rate dependence on separatrix shape for idealized equilibria of a field reversed theta pinch.** Anderson, D.V. (Texas Univ., Austin); Berk, H.L. 1980. NTIS, PC A12/MF A01.

From 22. annual meeting of the division of plasma physics of the APS; San Diego, CA, USA (10 Nov 1980).

The fastest growing ideal MHD modes in a field reversed theta pinch are in the infinite toroidal mode number limit and have low poloidal mode numbers. These are called cointerchange modes or less precisely ballooning modes. Simple analytical models for the equilibria were used to change the shape of the separatrix without changing the pressure function. For the cases examined, it is found that making the separatrix more racetrack in shape reduces growth rates near the vortex point but this is partially offset by an increase of the growth rates near the separatrix. The pressure function associated with the elliptical Hill's vortex model was used.

28931 (CONF-801119—, pp vp) **Transport and equilibrium in field reversed mirrors with toroidal field.** Auerbach, S.P. 1980. NTIS, PC A12/MF A01.

From 22. annual meeting of the division of plasma physics of the APS; San Diego, CA, USA (10 Nov 1980).

For a certain class of analytic equilibria, field reversal requires that a certain dimensionless parameter of the equilibrium, K,

must be small: 0 K or 1/3, expanding in powers of K, simple but accurate representations of these equilibria are developed. As an example, 0 point and separatrix radius are determined in terms of parametes under an experimentalists control: poloidal flux, axial current and vacuum field. As another example, classical transport is studied for a family of spherical equilibria ranging from the high beta Hill's vortex (k 0) to the zero beta spheromax (k 1/3). The classical L/R time for these equilibria is Tau (4 pi sigma sq R sub 0/sq C)(10-15 k)/1 where R sub 0 is the 0 point radius and sigma is the conductivity. The maximal toroidal field (k 1/3, zero beta) produces decay times only twice as large as the high beta, zero toroidal field case (k 0).

28932 (CONF-801119—, pp vp) **Measurements on the flow velocity of the BETA II field reversed plasma.** Granneman, E.H.A. (FOM Inst. for Atomic and Molecular Physics, Amsterdam); Turner, W.C. 1980. NTIS, PC A12/MF A01.

From 22. annual meeting of the division of plasma physics of the APS; San Diego, CA, USA (10 Nov 1980).

A pressure bar probe consisting of a piezoelectric crystal clamped between two quartz rods was used to measure the plasma flow velocity as a function of radius. Typically at 80 cm from the gun, maximum pressures of 5 to 8 atm were found at r or 10 cm. At early times (15 microsec after gun break down) when the plasma flow pressure is high, the density is found to be low (approximately 3.10 to the 14th power/cu cm). This indicates plasma with a high directed velocity (1 million m/s). This is confirmed by time of flight measurements made with magnetic probes. Later in time (after 25 microsec), the plasma flow pressure drops to values below 1 atm while the density reaches values of 3.10 to the 15th power/cu cm, indicating dense slow plasmas (r 100,000 m/s). After 30 microsec, the flow seems to stagnate completely. Because plasma flow velocities and/or temperatures can be deduced only the plasma density is known, the necessary complementary density measurements made with a HeNe laser interferometer are also given.

28933 (CONF-801119—, pp vp) **MHD tilting modes for arbitrary plasma pressure and configuration.** Hammer, J.H. 1980. NTIS, PC A12/MF A01.

From 22. annual meeting of the division of plasma physics of the APS; San Diego, CA, USA (10 Nov 1980).

A technique developed by Rosenbluth and Bussac was used to analytically examine the ideal MHD tilting instability of nearly spherical configurations. The extension was to an arbitrary (nearly spherical) separatrix shape that differs in general from the wall shapes and to arbitrary plasma Beta and current profiles. Results show that appropriate separatrix shaping as well as peaking the current near the vortex point give a factor of 5 improvement over stability conditions for the elliptical case. Walls close fitting at the poles can yield a factor of 2 improvement at best over a wall with delta constant and the same surface area. Extension of the wall inside the separatrix is stabilizing. After everything is optimized, the wall must still be order epsilon distant from the separatrix to insure tilting stability.

28934 (CONF-801119—, pp vp) **Stellarmak or FRMT: a stellarator - spheromak/FRM configuration.** Hartman, C.W. 1980. NTIS, PC A12/MF A01.

From 22. annual meeting of the division of plasma physics of the APS; San Diego, CA, USA (10 Nov 1980).

The usual spheromak is a low aspect ratio case of the diffuse toroidal pinch with B (toroidal) 0 on the outermost plasma surface. Diffuse pinch experiments show that reversed B (toroidal) is necessary to enter the quiescent regime. Reversed B (toroidal) can be achieved only by a spheromak by the addition of external transform windings (stellarator) windings. Controlled, surface-preserving ripple may allow steady state current to be driven by weak rotation of the plasma ions. The potential advantages of hybridization include (1) adding or reversing B (toroidal) increases shear and maximum, MHD-stable Beta (2) vacuum generated shear may improve MHD stability to kink, tilt, and slip and (3) electron trapping in a helical ripple may allow steady state with Beta sustained with directed neutral beams.

28935 (CONF-801119—, pp vp) **Numerical simulatons of BETA-II experiment.** Nash, J.K. (International Power Technology Inc., Sunnyvale, Calif.); Eddleman, J.L. 1980. NTIS, PC A12/MF A01.

From 22. annual meeting of the division of plasma physics of the APS; San Diego, CA, USA (10 Nov 1980).

Further applications of the MHD code HAM(1) were made to the Beta 2 magnetized coaxial plasma gun experiment at Livermore. Plasma gun rundowns were modeled for different gas fill pressures, capacitor bank energies, and ratio of electrode radii. Forced and passive reconnection of poloidal field lines is studied. Forced reconnection is accomplished with a fast pulsed coil near the gun muzzle. Passive reconnection is observed when a slow plasma divertor is placed between the electrodes, and when the gas density is reduced with an accompanying change in the gun geometry and capacitor bank.

28936 (CONF-801119—, pp vp) **Transport in field-reversed mirror.** Schumaker, D.E.; Boyd, J.K.; Auerbach, S.P.; McNamara, B. 1980. NTIS, PC A12/MF A01.

From 22. annual meeting of the division of plasma physics of the APS; San Diego, CA, USA (10 Nov 1980).

A code was written to describe the evolution of a field-reversed mirror. The plasma and magnetic field are assumed to be axisymmetric. The evolution calculation consists of two alternating steps, the solution of the 1-D transport equations and the solution of the 2-D equilibrium equations. The transport equations are the flux surface averaged transport equations of Braginskii. These transport equations advance quantities which are proportional to: (1) particle density, (2) electron entropy, (3) ion entropy, and (4) toroidal magnetic flux. In the absence of collisions these are adiabatic quantities.

28937 (GSI—81-1, pp 170-180) **Studies on electron capture excitation of multiply charged impurity ions in the TOKAMAK boundary plasma.** Winter, H. Jan 1981. Dep. NTIS (US Sales Only).

From 2. international workshop on multiply charge electron resonance ion sources; Darmstadt, F.R. Germany (8 Dec 1980).

A new diagnostic method is described which permits time dependent and spatially resolved determination of impurity ion concentrations in the boundary region of magnetically confined fusion plasmas. The method involves injection of a Li atom beam into the plasma and spectroscopical observation of the characteristic line radiation excited due to electron capture from Li atoms into specific excited impurity ion states. Quantitative measurements of ion concentrations are possible if the respective electron capture excitation-emission cross sections can be determined.

28938 (LA—8700-C, pp 52-55) **Classical transport in field reversed mirrors: reactor implications.** Auerbach, S.P.; Condit, W.C. Mar 1981. NTIS, PC A11/MF A01.

From 3. symposium on the physics and technology of compact toroids in the magnetic fusion energy program; Los Alamos, NM, USA (2 Dec 1980).

The classical diffusion coefficients for particles and heat in field reversed mirrors was evaluated with reference to a class of Hill's vortex models. Two fairly surprising results were obtained: (1) the diffusion driven flow of particles and heat is finite at the X-points and (2) the classical diffusion coefficients, which governs both particle and heat flux, is finite on the separatrix.

28939 (LA—8700-C, pp 76-79) **Simulation of the formation of the Princeton Spheromak.** Lui, H.C.; Chu, C.K.; Aydemir, A. Mar 1981. NTIS, PC A11/MF A01.

From 3. symposium on the physics and technology of compact toroids in the magnetic fusion energy program; Los Alamos, NM, USA (2 Dec 1980).

Several schemes with different field structure and current programming for the Princeton S-1 Spheromak are simulated with the aim of helping in its design and future operation. The method is based on numerically solving the single fluid compressible hydromagnetic equations with dissipation.

28940 **(LA-UR—81-3355) Exact invariants for time-dependent nonlinear Hamiltonian systems.** Lewis, H.R.; Leach, P.G.L. (Los Alamos National Lab., NM (USA); La Trobe Univ., Bundoora (Australia). Dept. of Applied Mathematics). 1981. Contract W-7405-ENG-36. 14p. (CONF-810385—4). NTIS, PC A02/MF A01. Order Number DE82004331.

From Conference on non-linear problems: present and future; Los Alamos, NM, USA (Mar 1981).

Two methods, one based on canonical transformations and one based on an assumed structure, are used to determine exact invariants for certain Hamiltonians of the type $H = 1/2\ p^2 + V(q,t)$. Invariants are found explicitly for a class of nonlinear, time-dependent potentials V(q,t). The former method is then developed to find exact invariants for Hamiltonians of the form H = H(q,p,rho(t),rho(t)).

28941 **(NRL-MR—4520) Resistive interchange modes in reversed-field pinches.** Finn, J.M.; Manheimer, W.M. (Naval Research Lab., Washington, DC (USA)). 24 Nov 1981. Contract AI01-76ET53020. 21p. NTIS, PC A02/MF A01. Order Number DE82004582.

A new regime is found in which the growth rate of the resistive interchange mode in cylindrical geometry is considerably smaller than previously believed. This stabilization is due to coupling to the external, tearing stable, region. Considering the crossover point from the conventional resistive interchange to the new regime as a critical beta, β/sub c/, we find β/sub c/ $\sim$ 7% for classical resistivity with T/sub e/ = 10 eV, in agreement with recent numerical studies. However, β/sub c/ scales as T/sub e// sup -3/5/, giving β/sub c/ $\sim$ 1% for T/sub e/ = 1 keV. Marginally stable pressure profiles for totally localized modes in the Bessel function model for a reversed field pinch are also computed, and show that the central pressure may be up to 400 times the pressure at the wall.

28942 **(NRL-MR—4640) Simple analysis of light-ion-beam losses in deuterium-plasma channels.** Colombant, D.G.; Goldstein, S.A. (Naval Research Lab., Washington, DC (USA); JAYCOR, Alexandria, VA (USA)). 16 Nov 1981. Contract AI01-76ET53020. 27p. NTIS, PC A03/MF A01. Order Number DE82004404.

Simple analysis of both ion beam energy losses and beam current density reduction is presented for deuterium plasma channels. It is found that whereas an optimum density may exist for reducing the beam energy losses in the channel, no optimum density can be found to minimize the beam current density reduction. Plasma channel radius effects are then examined. It is found that the total ion beam energy loss is not strongly dependent on the initial channel radius. We conclude that final focusing elements in conjunction with channels initially at rest allow for multiterawatt beams to be transported efficiently to 1 cm^2 targets while the channel cross-section can be larger.

28943 **(PB—81-858078) Boltzmann statistics applied to plasmas. January 1970-December 1980 (citations from the Searchable Physics Information Notices Data Base). Report for Jan 1970-Dec 1980.** (New England Research Application Center, Storrs, CT (USA)). Jan 1981. 94p. NTIS PC N01/MF N01.

This retrospective bibliography contains citations concerning the use of Boltzmann statistics in analyzing and simulating natural and man-made plasmas. Topics include kinetics of slightly relativistic plasmas, plasma turbulence in a magnetic field, trapped-particle instability, plasma waves (drift waves), laser plasma interactions, electron transport in laser produced plasmas, low-pressure gas discharge, TOKAMAK plasmas, and electrode phenomena in low-temperature plasmas. (Contains 81 citations, fully indexed and including a table of contents.)

28944 **(PPPL—1853) Plasma sweeper to control lower hybrid wave coupling.** Motley, R.W.; Glanz, J. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Nov 1981. Contract AC02-76CH03073. 12p. NTIS, PC A02/MF A01. Order Number DE82004735.

Experimental tests of an anti E x anti B plasma sweeper, designed to control the plasma density near the mouth of a phased waveguide array, are described.

28945 **(PPPL—1856) Transport of molecular impurities at the edge of tokamaks.** Langer, W.D. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Nov 1981. Contract AC02-76CH03073. 38p. NTIS, PC A03/MF A01. Order Number DE82004731.

The transport of molecules at the plasma edge in tokamaks is discussed in order to compare how light impurities enter the plasma if they are released either in atomic or molecular forms. Differences in their transport arise because of the dissimilarities between the atomic and molecular reactions with the bulk of the plasma. It is found that recycling to the walls is more efficient for the light impurities released in molecular form, but, also, that a substantial fraction of those atoms which originate from molecules may penetrate further into the plasma.

28946 **Progress in the spectroscopy of highly ionized atoms and its use in plasma diagnostics.** Cowan, R.D. (Los Alamos Scientific Lab., NM (USA)). *Physica Scripta;* **24**: No. 4, 615-621(Oct 1981).

During the past two decades, spectroscopic observations in high temperature astrophysical and thermonuclear-type plasmas have provided great impetus to the laboratory observations and analysis of spectra, especially those of highly ionized atoms. Thus the number of ions for which at least a few spectral lines have been identified has increased from 511 in 1959 to 648 in 1969 and to about 1019 in 1981. Much of the recent effort has gone into analyses for particular elements of interest (e.g. Fe and Ni for solar plasmas, and Cr, Fe, Ni, Mo, W, and Au for tokamak plasmas), or for simple isoelectronic sequences (e.g., those of neutral Ne, Na, Cu, Zn, Ag, and Tm). Some information now exists on atoms as highly ionized as Mo^{41+}, W^{46+}, and Au^{51+}. Although line identification work is far from complete, the interests of the user community are turning more and more toward the use of line intensities as diagnostics for determining plasma temperatures and densities. Very few of the required rate coefficients are known experimentally. It is important in theoretical calculations to include the resonance effects of autoionizing states, as these resonances frequently provide the dominant contribution to excitation, ionization, and recombination processes in low-density, high-temperature plasmas.

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REFER ALSO TO CITATION(S) 28158

28947 **(CONF-801119—, pp vp) Field reversed equilibria created by monoenergetic ions.** Brandenburg, J.E.; Post, R.F. 1980. NTIS, PC A12/MF A01.

From 22. annual meeting of the division of plasma physics of the APS; San Diego, CA, USA (10 Nov 1980).

Analytical model of field reversal is presented. Rotational symmetry and z independence are assumed the current being carried solely by monoenergetic ions of specified canonical angular momentum. Extending and further characterizing the results of Marx and Post, it is shown that within the reversal region, j varies directly as v/r. This result was used to derive an equation from which the self consistent magnetic field and the ion trajectories may be determined. Solutions to this equation show that strong field reversals can be obtained, in this model, for a/a sub o 2.5 and that delta B/B sub o is approximately (1 + the square root of a/s), where a and s are the inner and outer radii of the layer, respectively, and a sub o is the ion gyroradius in the vacuum field B sub o. It is also shown that a diffuse or sharp current profile can be obtained depending on the choice of parameters. Work in progress is also presented which shows the modification of the equilibria by additional particle groups, higher order multipole vacuum fields, and currents due to Boltzmann electrons.

28948 **(CONF-811040—101) Status and trends in the development and application of positive-ion-based neutral injectors.** Menon, M.M. (Oak Ridge National Lab., TN (USA)). 1981. Contract W-7405-ENG-26. 3p. NTIS, PC A02/MF A01. Order Number DE82002882.

From 9. symposium on engineering problems of fusion research; Chicago, IL, USA (26 Oct 1981).

The present status of the technology of positive-ion-based neutral injectors is examined with particular reference to the Oak Ridge National Laboratory neutral beam development program. It is shown that the development and application of multi-megawatt neutral beams have been quite successful. Injector parameters that have been utilized and those that are planned to be utilized in various confinement devices are examined. Development needs for the upcoming applications are shown to be primarily in the area of extending the beam pulse length to several seconds. The accomplishment of this goal will be a major step towards realizing a reactor-grade injector if the beam energy requirement for such an application is about 150 keV or less.

28949 **(CONF-811040—103) Structural design and analysis for the ISX-C/ATF tokamak of the vacuum vessel, coil joints, and supports.** Mayhall, J.A.; Cain, W.D.; Hammonds, C.J.; Johnson, R.L.; Gray, W.H. (Oak Ridge National Lab., TN (USA)). 1981. Contract W-7405-ENG-26. 3p. NTIS, PC A02/MF A01. Order Number DE82002784.

From 9. symposium on engineering problems of fusion research; Chicago, IL, USA (26 Oct 1981).

The ISX-C/ATF is being designed as a test bed for advanced toroidal concepts. Because of numerous design concepts being evaluated, a flexible, easily changeable structural-design math-model was needed to afford quick evalution of the structural feasibility of the many proposed concepts. To satisfy this need, the NASTRAN Automated Multi-Stage Substructures technique was used to build a quick-changeable math model. This technique was especially needed because all the coils, first wall and diagnostic devices are to be supported by the vacuum vessel, requiring the entire structure to be analyzed as a system. Without the use of the substructuring technique, the required man hours and computer core would have made timely design analysis impossible. To illustrate the technique, the detailed design analysis of the concept Torsatron (with helical coils and T.F. coils) is presented.

28950 (GSI—81-1, pp 1-22) **ECREVIS project: a status report (Dec 80).** Jongen, Y.; Pirart, C.; Ryckewaert, G. Jan 1981. Dep. NTIS (US Sales Only).

From 2. international workshop on multiply charge electron resonance ion sources; Darmstadt, F.R. Germany (8 Dec 1980).

ECREVIS is an highly stripped heavy ions source based on the E.C.R. principle. After an introduction of the project, a general view of the design of the source is given. The main magnetic bottle is made superconducting, with special attention paid to a low liquid helium boil-off. A scale model of this large superconducting magnetic bottle is under construction in the institute. The goals and characteristics of this model are explained. A special design cryopump has been designed, built and tested. It uses a cryogenerator, does not require any liquid nitrogen, and has a pumping speed of 8500 l/s for air. The beam line between the source and the cyclotron is almost finished and is undergoing first beam tests. Some design features are discussed. Finally some tests of extraction are described and unsuccesful results explained.

28951 (GSI—81-1, pp 23-40) **Status of the ECR ion source HISKA and first results of p-HISKA.** Bechtold, V.; Friedrich, L.; Schweickert, H. Jan 1981. Dep. NTIS (US Sales Only).

From 2. international workshop on multiply charge electron resonance ion sources; Darmstadt, F.R. Germany (8 Dec 1980).

The actual design of the heavy ion source HISKA will be presented. Details such as magnetic mirror geometry, vacuum configuration and the microwave feed in are discussed. Parallel to this work a small scale version of HISKA, the ECR ion source p-HISKA, was built up and tested. In November 1980 we succeeded in producing with this device 250 nA $^{14}n^{6+}$ at 10 KV extraction voltage.

28952 (GSI—81-1, pp 50-59) **Status report on ECR-activities at GSI.** Schulte, H. Jan 1981. Dep. NTIS (US Sales Only).

From 2. international workshop on multiply charge electron resonance ion sources; Darmstadt, F.R. Germany (8 Dec 1980).

On our last meeting at Louvain we reported on first tests with an ECR discharge in Ca vapor beams. This work was done with a 2.45 GHz magnetron generator in a 1st-stage like mirror configuration on the oven test stand. We did further experiments on Ba vapor with 2.45 GHz and with 14.3 GHz there, but these investigations did not yet evolve in a usuable method to produce pure metal plasma. After a visit to Grenoble last fall we decided to postpone this work and try a rare gas source first. Since our experiments in Geller's laboratory seemed to indicate that we could probably do without a first stage the source was planned as a 2nd-stage configuration (with permanent magnet heaxapole) only. This new test source is very small compared to the original Super-Mafios or even to Micro-Mafios. We are aware of the risk of leaving the secured path of a working system. Nevertheless, we thought we could afford to test some new ways, since our goal is somewhat different from that of the other groups: only moderate charge states-but higher currents.

28953 (GSI—81-1, pp 60-69) **Status of ISIS at JULIC.** Aldea, L.; Beuscher, H.; Bhandari, R.K.; Mathews, H.G.; Reich, J.; Wucherer, P. Jan 1981. Dep. NTIS (US Sales Only).

From 2. international workshop on multiply charge electron resonance ion sources; Darmstadt, F.R. Germany (8 Dec 1980).

The following 11 figures give some of the design details of the project ISIS (Injektion schwerer Ionen nach ECR-stripping), comprising an ECR-source, a beam preparation, guiding and injection system as well as a new RF-center region at JULIC.

28954 (GSI—81-1, pp 73-103) **Confinement and charge state distribution in E.C.R. sources.** Jongen, Y. Jan 1981. Dep. NTIS (US Sales Only).

From 2. international workshop on multiply charge electron resonance ion sources; Darmstadt, F.R. Germany (8 Dec 1980).

Starting from the experimental data of the Micromafios ion source, a new model has been built to explain the observed C.S.D. The effect of plasma on neutral density is analysed. The relation between C.S.D. in the plasma and in the extracted beam is recalled. Electrons and ions collision rates are evaluated, including temperature effects. A physical description in the confinement mechanism is given, from which diffusion times are evaluated. The model is compared with experimental data, showing good agreement. The effect of parameters variations is investigated, and C.S.D. are computed for the ECREVIS source presently under construction. Finally, a very simple method is presented to investigate magnetic bottle design, by reconstruction of field lines.

28955 (GSI—81-1, pp 108-131) **Charge distribution in E.C.R. ion sources.** Jongen, Y. Jan 1981. (In French). Dep. NTIS (US Sales Only).

From 2. international workshop on multiply charge electron resonance ion sources; Darmstadt, F.R. Germany (8 Dec 1980).

Starting from the experimental data of the Micromafios ion source, a new model has been built to explain the observed C.S.D. The effect of plasma on neutral density is analysed. The relation between C.S.D. in the plasma and in the extracted beam is recalled. Electrons and ions collision rates are evaluated, including temperature effects. A physical description in the confinement mechanism is given, from which diffusion times are evaluated. The model is compared with experimental data, showing good agreement. The effect of parameters variations is investigated, and C.S.D. are computed for the ECREVIS source presently under construction. Finally, a very simple method is presented to investigate magnetic bottle design, by reconstruction of field lines.

28956 (GSI—81-1, pp 132-139) **Diagnostic of high energy electrons in an ECR-discharge by means of X-ray measurements.** Bernhardi, K. Jan 1981. Dep. NTIS (US Sales Only).

From 2. international workshop on multiply charge electron resonance ion sources; Darmstadt, F.R. Germany (8 Dec 1980).

Bremsstrahlung measurements and subsequent numerical determination of the velocity distribution function of hot electrons are a valuable diagnostic tool for investigating ECR-plasmas. In this talk I will present some results obtained by us at the ECR-device in Marburg and Bochum from volume bremsstrahlung measurements. The results of the density and distribution function measurements of ECR-plasmas turn out to be in contrast to results obtained by other groups. In order to demonstrate the differences between their re-

sults and ours I will firstly give a short overview over the experimental and theoretical investigations hitherto made on this field. After this I will describe an improved collimator developed by us. Finally I will present the results obtained by us. I will discuss them with respect to the hitherto not well understood ECR-heating mechanisms.

28957 (GSI—81-1, pp 140-148) **Influence of charge changing collisions on charge state distributions (CSD) in non-equilibrium plasmas.** Hesse, J. Jan 1981. Dep. NTIS (US Sales Only).

From 2. international workshop on multiply charge electron resonance ion sources; Darmstadt, F.R. Germany (8 Dec 1980).

For an optimal design of ion sources and for some aspects of plasma diagnostics it is important to study the influence of all processes and parameters that are essential for the production and loss of multiply charged ions. Till now all existing calculations of CSD neglected charge transfer because of missing data. Now many of the very big charge transfer cross sections are measured and so we are able to include them into our calculations.

28958 (INIS-SU—25, pp 37-43) **Complex of programs for calculations of one-dimensional problems of neutron and gamma quantum transport.** Marin, S.V.; Markovskii, D.V.; Pal'vanov, V.Ch.; Turbina, T.A.; Shatalov, G.E. 1979. (In Russian). Dep. NTIS (US Sales Only).

From 2. all-union conference on ionizing radiation protection of industrial nuclear plants; Moscow, USSR (19 Dec 1978).

A complex of programs for neutron-physical calculation of a thermnuclear reactor blanket is described The base of the o-/ complex is the BLANK program, by means of which the neutron spatial energy distribution in one-dimensional geometry is determined and then flux linear functionals are calculated. To solve the neutron transport equations in the energy range from 0.1 to 15 MeV different approximations are used: the Monte-Carlo method in combination with a detailed system of constants for high energy range as well as Psub(I) approximation for energies below the limiting value (0.1 MeV). Working constants for this energy range are calculated by means of the NEDAM program. To obtain the exact solution of gamma radiation transport equation in the energy range from 100 to 0.005 MeV and to calculate energy release in one-dimensional models the BLAGAM program has been prepared. Integral equation of gamma radiation transport is solved by the direct Monte Carlo method . Cross sections of gamma radiation interaction with a matter are obtained by this program. Library of cross sections of gamma radiation generation in the interaction of neutrons with matters in the energy range of 1-14 MeV is obtained using the ISIGAM program in the format of 52 groups in neutron energy and 18 groups in gamma radiation energy. The described complex of programs provides the high accuracy of calculating the neutron flux density and its functionals at computer time expenses of an order of 5-10 min per a version.

28959 (INIS-SU—87, pp 214) **Fuel cycle of the lithium zone of the INTOR blanket.** Vasil'ev, V.G.; Ershova, Z.V.; Shulyatikov, B.V.; Yakunin, S.A. (Vsesoyuznyj Nauchno-Issledovatel'skij Inst. Neorganicheskikh Materialov, Moscow (USSR)). 1981. (In Russian). Dep. NTIS (US Sales Only).

From 2. all-union conference on engineering problems of thermonuclear reactors; Leningrad, USSR (23 Jun 1981).

28960 (INIS-SU—87, pp 216) **Experimental evaluation of tritium breeding by means of 14.8 MeV neutrons.** Evgrafov, D.I.; Kapyshev, V.K.; Malek, M.P.; Melent'ev, V.I.; Ovechkin, V.V.; Sakharov, V.I. (Vsesoyuznyj Nauchno-Issledovatel'skij Inst. Neorganicheskikh Materialov, Moscow (USSR)). 1981. (In Russian). Dep. NTIS (US Sales Only).

From 2. all-union conference on engineering problems of thermonuclear reactors; Leningrad, USSR (23 Jun 1981).

28961 (INIS-SU—87, pp 215) **Tritium extraction from lithium ionorganic compounds reasonable for breeding zone of a thermonuclear reactor.** Vasil'ev, V.G.; Ershova, Z.V.; Nikiforov, A.S. (Vsesoyuznyj Nauchno-Issledovatel'skij Inst. Neorganicheskikh Materialov, Moscow (USSR)). 1981. (In Russian). Dep. NTIS (US Sales Only).

From 2. all-union conference on engineering problems of thermonuclear reactors; Leningrad, USSR (23 Jun 1981).

28962 (INIS-SU—87, pp 60) **Thermal-physical properties of dielectric materials and designs of the insulation of the electromagnetic system windings of the T-15 thermonuclear device.** Temkin, A.G.; Stepanov, A.N.; Churakov, G.F.; Shirshova, T.M.; Vorp, Kh.M.; Valpeter, M.V.; Iltin', I.R.; Iltinya, M.P. (Rizhskij Politekhnicheskij Inst. (USSR)). 1981. (In Russian). Dep. NTIS (US Sales Only).

From 2. all-union conference on engineering problems of thermonuclear reactors; Leningrad, USSR (23 Jun 1981).

28963 (LA—8700-C, pp 31-35) **On the use of intense electron and ion beams and rings.** Fleischman, H.I. Mar 1981. NTIS, PC A11/MF A01.

From 3. symposium on the Physics and Technology of Compact Toroids in the Magnetic Fusion Energy Program; Los Alamos, NM, USA (2 Dec 1980).

Three distinctively separate ring configurations are considered for compact toroid (CT) applications. Included are the small orbit field reversed and the large orbit field reversed ion ring compressor. The basic advantages and disadvantages of requiring only simple external magnetic configuration and of not requiring material coils linking through the plasma ring are discussed. Various mixed-CT configurations involving the use of intense high energy electron and/or ion beams are suggested with the aim to avoid some of the more disadvantageous characteristics.

28964 **(ORNL—5830) Radiation facilities for fusion-reactor first-wall and blanket structural-materials development.** Klueh, R.L.; Bloom, E.E. (Oak Ridge National Lab., TN (USA)). Dec 1981. Contract W-7405-ENG-26. 50p. NTIS, PC A03/MF A01. Order Number DE82004557.

Present and future irradiation facilities for the study of fusion reactor irradiation damage are reviewed. Present studies are centered on irradiation in accelerator-based neutron sources, fast- and mixed-spectrum fission reactors, and ion accelerators. The accelerator-based neutron sources are used to demonstrate damage equivalence between high-energy neutrons and fission reactor neutrons. Once equivalence is demonstrated, the large volume of test space available in fission reactors can be used to study displacement damage, and in some instances, the effects of high-helium concentrations and the interaction of displacement damage and helium on properties. Ion bombardment can be used to study the mechanisms of damage evolution and the interaction of displacement damage and helium. These techniques are reviewed, and typical results obtained from such studies are examined. Finally, future techniques and facilities for developing damage levels that more closely approach those expected in an operating fusion reactor are discussed.

28965 **Energy conversion for fusion systems.** Miley, G.H. (Univ of Ill, Urbana). *ASEE Annu Conf Proc 89th Educ and Ind: A Jt Endeavor;* **2**: 549-554(1981). (CONF-810627—).

From American Society for Engineering Education annual conference; Los Angeles, CA, USA (22 Jun 1981).

The potential importance of direct energy conversion to the long-term development of fusion power is discussed with stress on the possibility of reducing waste heat rejection, a crucial issue for any central power station in the 21st century. Two approaches, direct collection and magnetic expansion, are reviewed. Due to the intimate connection between the type of fusion fuel, the confinement scheme, and the energy conversion technique, all three elements are considered. 28 refs.

28966 **Erosion of the first wall of Tokamaks.** Guseva, M.I.; Ionova, E.S.; Martynenko, Yu.V. *Soviet Atomic Energy (English Translation);* **48**: No. 3, 182-186(Mar 1980).

An estimate of the rate of erosion of the wall due to sputtering and blistering requires knowledge of the fluxes and energies of the particles which go from the plasma to the wall, of the sputtering coefficients S, and of the erosion coefficients S* for blistering. The overall erosion coefficient is equal to the sum of the sputtering coefficient and the erosion coefficient for blistering. Here the T-20 Tokamak is examined as an example of a large-scale Tokamak. 18 refs.

99 GENERAL AND MISCELLANEOUS

REFER ALSO TO CITATION(S) 28072

9901 Management

28967 (UCRL—52000-82-2, pp 19-29) **Moving in.** Feb 1982. NTIS, PC A03/MF A01.

In Energy and technology review.

The Laboratory celebrates its thirtieth anniversary in 1982; in this article, we recall some of the events of that first year when the Lab was moving into and getting started in Livermore.

9902 Mathematics And Computers

REFER ALSO TO CITATION(S) 27636, 27689, 27690, 27771, 27772, 27773, 27774, 28039, 28227, 28268, 28426

28968 (CERN—81-07, pp 266-275) **User aspects of MICE.** Blanc, J.A.; Joosten, J.; Letheren, M.; van Praag, A. (European Organization for Nuclear Research, Geneva (Switzerland)). 17 Jul 1981. Dep. NTIS (US Sales Only).

From Conference on the application of microprocessors to high energy physics experiments; Geneva, Switzerland (4 May 1981).

MICE is a MICro-programmable Engine designed for on-line filtering applications. It efficiently emulates the PDP-11 fixed-point instruction set. This feature facilitates the development of user software as algorithms can be coded in standard languages (FORTRAN, PL11, Assembler, etc.). MICE executes PDP-11 code 3 times faster than a PDP-11/70, or 10 times faster than a PDP-11/34. Algorithms can be made to run faster by micro-coding the time critical part of the code (often a small fraction of the total code). Further speed increases can be achieved by attaching special-purpose hardwired logic to the CPU. Those features are described which make MICE a user-friendly device in the real-time experimental environment encountered at CERN.

28969 (CERN—81-07, pp 533-543) **SUPER CAVIAR: memory mapping the general-purpose microcomputer.** Cittolin, S.; Taylor, B.G. 17 Jul 1981. Dep. NTIS (US Sales Only).

From Conference on the application of microprocessors to high energy physics experiments; Geneva, Switzerland (4 May 1981).

Over the past 3 years, CAVIAR (CAMAC Video Autonomous Read-out) microcomputers have been applied in growing numbers at CERN and related institutes. As typical user programs expanded in size, and the incorporated firmware libraries were enlarged also, the microprocessor addressing limit of 64 Kbytes became a serious constraint. An enhanced microcomputer, SUPER CAVIAR, has now been created by the incorporation of memory mapping to expand the physical address space to 344 Kbytes. The new facility provides independent firmware and RAM maps, dynamic allocation of common RAM, automatic inter-page transfer modes, and a RAM/EPROM overlay. A memory-based file system has been implemented, and control and data can be interchanged between separate programs in different RAM maps. 84 Kbytes of EPROM are incorporated on the mapper card itself, as well as an ADLC serial data link. In addition to providing more space for consolidated user programs and data, SUPER CAVIAR has allowed the introduction of several improvements to the BAMBI interpreter and extensions to the CAVIAR libraries. A context editor and enhanced debug monitor have been added, as well as new data types and extended array-handling and graphics routines, including isoline plotting, line-fitting and FFT operations. A SUPER CAVIAR converter has been developed which allows a standard CAVIAR to be upgraded to incorporate the new facilities without loss of the existing investment.

28970 (CERN—81-07, pp 579-584) **Microprocessor controlled three-port interface to the 168/E processor.** Rost, M.; Iksal, G. (Gesamthochschule Siegen (Germany, F.R.). Fachbereich Naturwissenschaften 1 - Physik). 17 Jul 1981. Dep. NTIS (US Sales Only).

From Conference on the application of microprocessors to high energy physics experiments; Geneva, Switzerland (4 May 1981).

The 168/E is a SLAC developed, fast processor, which emulates the IBM 370/168. For many applications one is forced to overlay the processor's memory. We designed an interface, which connects the 168/E to a host-computer and a low cost MOS-memory with an address-space of 4 M-bytes. This three-port interface is controlled by the Motorola MC 68000 microprocessor which also manages the execution of the several overlays. Since all control is performed by the 68000 software, the interface hardware is relatively simple. Seen from the host-computer side it connects the host to a 168/E-processor with a large memory. No restrictions are made to the number of program or data overlays. The maximum time spent overlaying the whole 168/E program and exchanging all data is limited to 70 msec. The connection of additional 168/E processors is possible.

28971 (CERN—81-07, pp 585-587) **Cross software for microprocessor program development at CERN.** von Eicken, H.; Montuelle, J.; Willers, I.; Blake, J. 17 Jul 1981. Dep. NTIS (US Sales Only).

From Conference on the application of microprocessors to high energy physics experiments; Geneva, Switzerland (4 May 1981).

Programs for a variety of microprocessors (including Intel 8080; Motorola 6800 and 6809 and 68000; and Texas Instruments 9900) can be prepared on different host computers (such as IBM 370, CDC 6000, and Nord 10) using portable programs developed at CERN. The range of cross software consists of: an assembler for each target microprocessor, a single linkage editor, a single object module librarian, and a variety of pre-loaders which convert object modules from CERN's format (CUFOM) into manufacturers' formats. The programs are written in BCPL and PASCAL, programming languages which are available on a wide range of computers.

28972 (CERN—81-07, pp 588-593) **Linking basic variables to binary data world.** Hoan, N.N. 17 Jul 1981. Dep. NTIS (US Sales Only).

From Conference on the application of microprocessors to high energy physics experiments; Geneva, Switzerland (4 May 1981).

Personal microcomputers have gained unprecedented popularity thanks to the BASIC language handiness. Its use in small data acquisition system encounters, however, two main drawbacks. The first concerns the slow response of the BASIC interpreter implemented in these small systems; the second is due to a very poor communication between the BASIC world and the machine-coded world. All BASIC symbols for variables, arrays or strings which are so easy to handle, remain unknown to the acquisition machine-language program. Moreover, complex mathematical expressions needed for, say, some non linear correction or control, could be managed in BASIC but would be painful to program even in Assembler's language. This paper shows that, using the dynamical variable pointer, one can implement a natural link between the two worlds, allowing powerful features to BASIC's interpreter in data acquisition systems. In particular, (a) A machine coded program written for data logging can get access to BASIC variables and directly transfers data to them without suffering interpreters slow speed. BASIC programs just use them as any other variables. (b) A manifold user's call, giving control to different machine coded programs without having to change the user's address as usual.

28973 (CERN—81-07, pp 594-602) **Multi-microcomputer system for Monte Carlo calculations.** Hertzberger, L.O. (Nationaal Inst. voor Kernfysica en Hoge-Energiefysica (NIKHEF), Amsterdam (Netherlands)); Berg, B.; Krasemann, H. 17 Jul 1981. Dep. NTIS (US Sales Only).

From Conference on the application of microprocessors to high energy physics experiments; Geneva, Switzerland (4 May 1981).

We propose a microcomputer system which allows parallel processing for Monte Carlo calculations in lattice gauge theories, simulations of high energy physics experiments and presumably many other fields of current interest. The master-n-slave multiprocessor system is based on the Motorola MC 68000 microprocessor. One attraction if this processor is that it allows up to 16 M Byte random access memory.

28974 **(SAND—81-2541C) Modified cascade structure for IIR adaptive algorithms.** David, R.A. (Sandia National Labs., Albuquerque, NM (USA)). 1981. Contract AC04-76DP00789. 5p. (CONF-811139—2). NTIS, PC A02/MF A01. Order Number DE82003048.

From 15. annual asilomar conference on circuits, systems and computers; Monterey, CA, USA (9 Nov 1981).

This paper introduces an IIR adaptive algorithm based on gradient search techniques which is easily constrained to remain stable during the adaptive process. Using a modified cascade structure, zeros are realized in a direct tapped-delay-line form while poles are realized as a series of second order sections in cascade. Thus, maintaining stability during the adaptive process is simplified to checking the coefficients of a series of second order polynomials to be sure the roots are within the stable region.

28975 **Monte Carlo estimation of percentiles for the multi-Smirnov test.** Gardner, R.H.; Pinder, J.E. III; Wood, R.S. (Savannah River Ecology Lab., Aiken, SC). *Journal of Statistical Computation and Simulation;* **10**: 243-249(1980). Contract EY-76-C-09-0819;W-7405-ENG-26.

The usefulness of multi-sample statistics of the Smirnov type is limited because the percentiles of the test statistics are known only for the three-sample case with small ($\leqq$ 40) and equal sample sizes. To improve the usefulness of these procedures, we employ Monte Carlo techniques to determine the percentiles for the multi-sample Smirnov test where the number of samples ranged from 4 to 10 and the sample sizes are equal, and for the three-sample Smirnov test wth unequal sample sizes.

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Qualifier
Title, (supplementary information), citation number, (report number)

The title may be supplemented with additional words, or a phrase, if it appears additional information would be helpful. In cases for which the title contains little or no information related to the subject entry, it may be replaced entirely by the supplementary information. A qualifier is not always required, and in such cases the title will follow the unqualified subject descriptor.

The descriptors selected for use as subject terms are generally the names of specific materials, things, or processes. To the extent possible, a qualifier is selected to describe the properties of, or processses applied to, the subject term.

Index entries are selected to indicate the important ideas and concepts presented in a document, rather than words that may appear in the text. Within the available thesaurus terms, the most probable or logical place to look for typical information is selected. "See references" are included to guide users from synonymous terms or phrases to the descriptor selected as a subject heading for the concept. (e.g. Pipeline Quality Gas see HIGH BTU GAS). "See also references" are used to indicate where to find references to subject concepts that are narrower, broader, or related to a particular subject heading. To complete an exhaustive search of a given subject, all such headings should be reviewed.

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4	*See* LBL-11052	DE82003711	MN -11	7:28515
CONF-800655-	(21. annual meeting of the Institute of Nuclear Materials Management, Palm Beach, FL, USA, 30 Jun-2 Jul 1980)			
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CONF-8009165-	(2. workshop on incentives to stimulate solar energy use, Seattle, WA, USA, 2-5 Sep 1980)			
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CONF-8009198-	(5. national Soviet conference on neutron physics, Kiev, Ukrainian SSR, 15-19 Sep 1980)			
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CONF-8009220-	(International conference on electromagnetic compatibility, Southampton, UK, 16-18 Sep 1980)			
1	*See* UCRL-85809	DE82001667	MN -37	7:28443
CONF-801082-	(ORAU radiopharmaceutical dosimetry symposium, Oak Ridge, TN, USA, 6-10 Oct 1980)			
6	NTIS, PC A02/MF A01	DE82002778	MN -41	7:28924
CONF-801144-	(International meeting on development, fabrication, and application of reduced-enrichment fuels for research and test reactors, Argonne, IL, USA, 13-14 Nov 1980)			
3	*See* CEA-CONF-5762	DE81700686	MN -41	7:28031
CONF-801156-	(Symposium on diesel fuel obscurants, Ft Detrick, MD, USA, 13-14 Nov 1980)			
2	NTIS, PC A02/MF A01	DE82004079	MN -11	7:28461
CONF-801269-	(3. colloquium on the development of metal investigation methods, Saint-Etienne, France, 3-5 Dec 1980)			
4	*See* CEA-CONF-5724	DE81700706	MN -25	7:28141
CONF-810326-	(Annual meeting on nuclear technology, Dusseldorf, F.R. Germany, 24-26 Mar 1981)			
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4	*See* LA-UR-81-3355	DE82004331	MN -20g	7:28940
CONF-8103106-	(IAEA specialist meeting on high burn-up in power water reactor fuel, Mol, Belgium, 23-27 Mar 1981)			
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CONF-810509-	(Annual conference of the International Solar Energy Society, Philadelphia, PA, USA, 26-30 May 1981)			
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7	*See* CEA-CONF-5738	DE81700695	MN -23	7:28314
CONF-810588-	(DOE/NBS workshop on environmental speciation and monitoring needs, Gaithersburg, MD, USA, 18-20 May 1981)			
5	*See* LBL-13308	DE82003331	MN -4	7:27723
CONF-8105128-	(Workshop on hot laboratories and remote handling, Karlsruche, F.R. Germany, 21-22 May 1981)			
2	*See* CEA-CONF-5723	DE81700700	MN -71	7:28206
CONF-8105131-	(13. annual national conference on radiation control, Little Rock, AR, USA, 2-6 May 1981)			
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CONF-810625-	(ASME PVP conference, Denver, CO, USA, 21-26 Jun 1981)			
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	2: 549-554(1981)			7:28965
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	Oregon Graduate Center, Beaverton, OR			7:27800
CONF-8106181-	(Health physics summer school on selected topics in reactor health physics, Lexington, KY, USA, 14-19 Jun 1981)			
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15	*See* LBL-13343	DE82003714	MN -61a	7:27796
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38	*See* LBL-13015	DE82003901	MN -38	7:28144
CONF-810899-	(Actinide recovery symposium, New York, NY, USA, 24 Aug 1981)			
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1	*See* LA-UR-81-3484	DE82004372	MN -4	7:27791
CONF-8109125-	(3. European symposium on enhanced oil recovery, Bournemouth, UK, 21-23 Sep 1981)			
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35	*See* SLAC-PUB-2728-Rev.	DE82003563	MN -32	7:28426
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3	NTIS, PC A02/MF A01	DE82002814	MN -95d	7:28112
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101	NTIS, PC A02/MF A01	DE82002882	MN -20	7:28948
103	NTIS, PC A02/MF A01	DE82002784	MN -20d	7:28949
CONF-811042-	(9. water reactor safety research information meeting, Washington, DC, USA, 26-28 Oct 1981)			
18	*See* HEDL-SA-2546	DE82003795	MN -78	7:27976
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3	*See* HEDL-SA-2540	DE82003767	MN -78	7:28009
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CONF-811101-	(Winter annual meeting of the ASME Technology and Society Division, Washington, DC, USA, 15-20 Nov 1981)			
12	*See* LBL-13359	DE82003621	MN -25	7:28145
13	*See* HEDL-SA-2296-FP	DE82003790	MN -79p	7:28034
16	NTIS, PC A02/MF A01	DE82004098	MN -77	7:28004
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52	*See* HEDL-SA-2419-FP	DE82003776	MN -79	7:27993
54	NTIS, PC A02/MF A01	DE82004122	MN -41	7:28526
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6	*See* HEDL-SA-2387-FP	DE82003799	MN -79b	7:27990
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20	NTIS, PC A02/MF A01	DE82004121	MN -25	7:28142

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2	*See* SAND-81-2541C	DE82003048	MN -32	7:28974
3	*See* SAND-81-2540C	DE82003047	MN -32	7:28227
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2	NTIS, PC A02/MF A01	DE82003995	MN -77	7:27985
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1	NTIS, PC A04/MF A01	DE82004119	MN -80	7:28002
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3	*See* LA-UR-81-2484	DE81030251	MN -11	7:28462
5	*See* BNL-30101	DE82002225	MN -11	7:28460
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